Utah
Water Quality Assessment
Report to Congress 2002

Department of
Environmental Quality

Division of
Water Quality

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Report to Congress

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Department of Environmental Quality
Division of Water Quality
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Chapter I: Executive Summary

Introduction

Utah's surface water resources include 14,250 miles of rivers and streams, nearly 3,000 lake and reservoirs. Utah is the second driest state in the country and these waters play a major role in the private, commercial and industrial development of the state. They are sources of drinking water, provide enormous recreational opportunities, sustain a wide variety of wildlife, and provide water for agricultural production. Utah's beneficial use classifications for waters of the state are listed in Table VI-5.

Utah assesses the quality of its surface water resources to protect it for drinking, fishing, boating, irrigation, stock watering, and supporting aquatic wildlife. Data are compared against State water quality standards to determine beneficial use support (DWQ, 2000). Various reports are written and disseminated to project sponsors, local and state officials, government and private entities and the public to expand the awareness of the need to protect and enhance the water quality of Utah's rivers, streams, lakes and reservoirs. In addition, water quality data are used to identify impaired waterbodies and establish water quality goals for implementing projects to restore or protect water quality. Water quality data are also collected to do Total Maximum Daily Load analyses for discharge permits and to assure that permit requirements under the Utah Pollution Discharge Elimination System (UPDES) program are being met. Data are also collected to evaluate the effectiveness of nonpoint source projects, and to do TMDL analyses on selected waterbodies or watersheds.

Stream Monitoring

The stream monitoring program consists of basin intensive and long-term ambient water quality monitoring stations. The fixed-station monitoring network consisted of 64 stations. These stations will be used to evaluate long-term water quality trends. Samples are collected every six weeks (eight times per year).

The data collected and analyzed provide essential river and stream water quality assessment data to identify and quantify water quality problems that may exist and provide background information for the development of possible solutions to those problems. They also allow water quality programs to be focused on critical areas, and allow the Division of Water Quality to prioritize its management plans. The data are used to determine the effectiveness of the Division's water quality management plans and to assist individuals and agencies involved in protecting the quality of the State's waters.

Rivers / Streams Assessment

For the purposes of this report, the statewide assessment consists of the summary evaluations of two intensive monitoring surveys. These two watershed management units were the Sevier River and the Utah Lake-Jordan River systems. These were combined with previous surveys done in the Bear River, Weber River, Uinta, Colorado River West, Colorado River Southeast, Cedar/Beaver and Lower Colorado Watershed Management Units (Figure I-1).

Assessments were done on some streams within these latter watershed units and the results of previous assessments were updated.

Data collected by the Division of Water Quality and others were assessed following the procedures described in Chapter VI. Data were obtained through cooperative agreements with the U.S. Forest Service, U.S. Bureau of Land Management, Salt Lake City, Central Utah

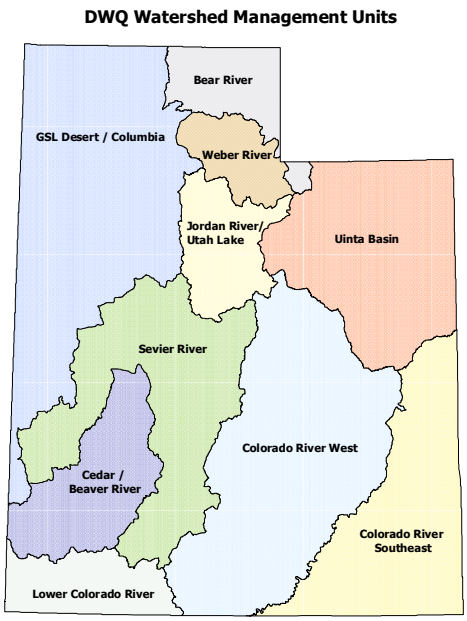

Figure I-1. Watershed Management Units.

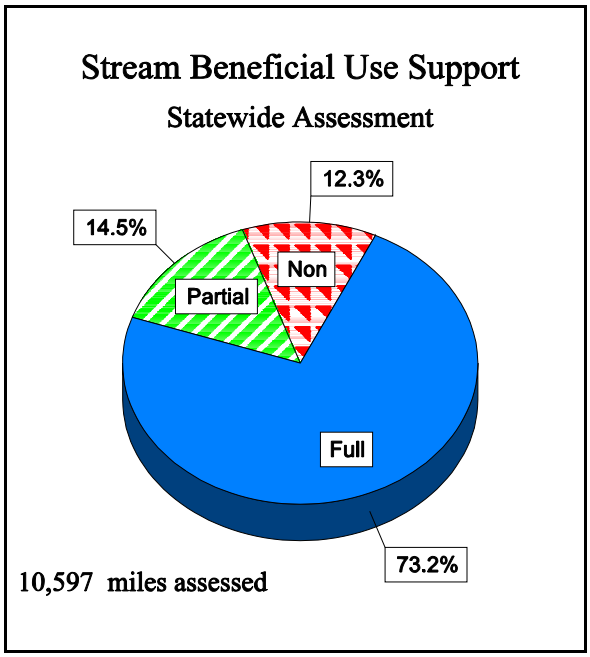

Figure I-2. River / Stream beneficial use assessment.

Conservancy District, and the Jordanelle Technical Advisory Committee. These cooperative agreements included the collection and processing of samples at the State Health Laboratory. Data collected by the United States Geological Survey for their Great Salt Lake Basins NAWQA program, benthic macroinvertebrate and sediment data collected by Dr. Lawrence Gray of Utah Valley State College, and fish tissue data collected by the Uinta National Forest were also used to assess water quality.

Utah assessed approximately 10,597 miles of perennial streams. This is 74.4% of the perennial stream miles in the state and is based upon the State's most recent stream mileage calculations. This is less that EPA's estimates of 16,497 miles, but the State's estimate is considered more accurate. Of the miles assessed, 73.2% were assessed as fully supporting, 14.5% as partially supporting, and 12.3% as not supporting at least one beneficial use designation (Figure I-2).

A map of the overall beneficial use support for the state can be found in Chapter II, Figure II-2. However, the majority of streams were not assessed for Class 2B (contact recreation) Therefore, the assessment is primarily based on Class 1C (source of drinking water), aquatic life beneficial uses (3A, 3B, 3C, and 3D), and Class 4 (agriculture use). Table I-1 lists individual beneficial use support.

The major causes of water quality impairment are total dissolved solids, nutrients, sediments, and stream habitat alterations. Stream habitat alterations include riparian habitat and in-stream habitat. The major sources of pollutants are agriculture, natural sources, hydrological modification, and habitat modification. About 2% percent of the stream miles are affected by point source discharges. Agricultural practices, such as grazing and irrigation, caused increased nutrient and sediment loading into streams. Point sources are also responsible for nutrient input into streams, while natural sources contributed metals, total dissolved solids and sediments to streams in some areas. Resource extraction and associated practices such as road construction contributed significantly to

impairment of water quality also.

Utah's proposed 303(d) list includes 84 stream waterbodies. Because multiple factors affect some of the waterbodies, 122 parameters were listed for TMDL analysis.

Lakes / Reservoirs

The 131 lakes assessed during this reporting cycle account for 95% (460,642 acres) of the total lake acreage in the state. When accounting by acreage, 69% was found supporting its designated uses, 31% was partially supporting and about 0.4% was not supporting designated uses.

Of the 131 lakes surveyed, 71 (54%) were fully supporting, 49 (37%) partially supporting, and 11 (8%) not supporting.

The causes of impairment in lakes and reservoirs continue to be nutrients, siltation, low dissolved oxygen, suspended solids, organic enrichment, and noxious aquatic plants.

The major sources of pollutants causing impairments are nonpoint sources, agricultural practices, industrial and municipal point sources, and habitat modification (draw-down of reservoirs).

Forty-three lakes remain on the 303(d) list, including a total of 69 parameters that need TMDL analysis. No lakes have been added to the list since the last reporting cycle. However, TMDLs for seven lakes have been written and approved by EPA. We will request that these be removed in the next reporting cycle. Nine additional lakes fell into the partially supporting category and one into the non-supporting category. Some of these 10 lakes have fluctuated in and out of full support status for several reporting cycles, while others, we feel, came under additional stress due to drought conditions. Figure I-3 shows the lake beneficial use assessment for this report.

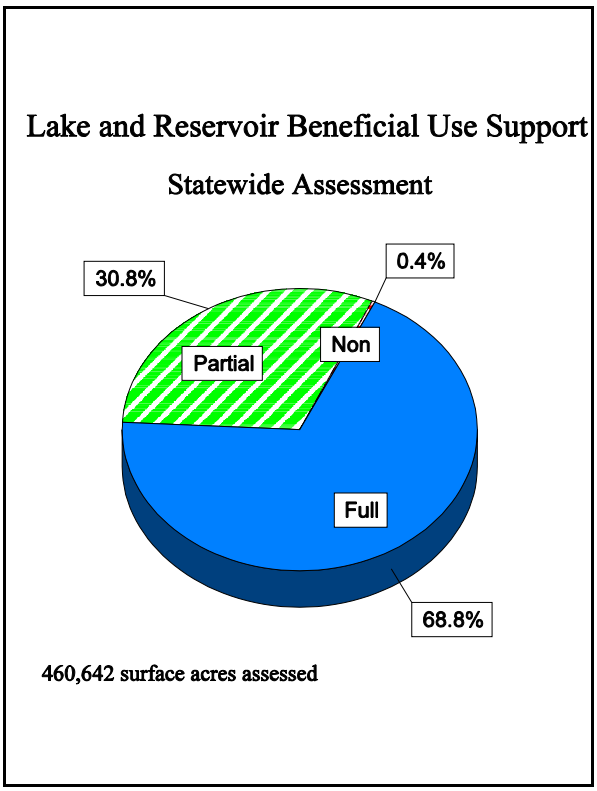

Figure I-3. Lake / Reservoir beneficial use assessment.

Table I-1. Individual Use Support Summary							
Goals[a]	**Use**	**Size Assessed**	**Size Fully Supporting**	**Size Fully Supporting but Threatened**	**Size Partially Supporting**	**Size Not Supporting**	**Size Not Attainable**
Protect & Enhance Ecosystems	Aquatic Life	10,543.0	8868.9 (85.2%)	-	1532.6 (12.4%)	364.7 (3.5%)	0.0
Protect & Enhance Public Health	Fish Consumption	46.8	0.0	-	0.0	46.8 (1005)	0.0
	Swimming[b]	185.4	86.0 (46.5%)	-	89.6 (48.3%)	9.8 (5.2%)	0.0
	Secondary Contact	185.4	86.0 (46.5%)	-	89.6 (48.3%)	9.8 (5.2%)	0.0
	Drinking Water	3,883.6	3,799.9 (97.3%)	-	45.1 (1.2%)	38.5 (1.1%)	0.0
Social and Economic	Agricultural	10,244.1	8,732.2 (85.3%)	-	483.7 (4.7%)	1,026.2 (10.0%)	0.0
	Overall Use Support	10,597.0	7,760.9 (73.2%)	0.0	1,532.6 (14.5%)	1,303.9 (12.3%)	0.0

[a] These goals are part of the national water quality goals adopted by the EPA Office of Water and the ITFM in their Environmental Goals and Indicators effort.
[b] Class 2B (secondary contact) streams were evaluated as swimmable for proposes of the CWA goals, therefore the swimming and secondary contact classification categories are the same.

Chapter II: Statewide River and Stream Water Quality Assessment

Statewide Water Quality Summary

The statewide assessment consists of the summary evaluations of two watershed management units. These watersheds were the Sevier River and Utah Lake-Jordan River Watershed Management Units. The results were combined with the results of previous regional assessments for the Uinta, Colorado River West, Colorado River Southeast, Cedar/Beaver, and Lower Colorado watershed management units. Some streams in these latter watersheds were also assessed during this cycle.

Utah has adjusted its estimate of perennial stream miles to 14,250 miles as compared to EPA's estimate of 16,457 miles. The primary difference is that the State's calculation of stream miles did not include the stream length through lakes and reservoirs. The other difference was in the designation of which stream segments were perennial and which ones were not. Statewide assessment of streams came to 10,597 miles for this 305(b) reporting period. This was 74.4% of the perennial stream miles in the state.

Overall Use Support--Of the 10,597 stream miles assessed, 7,761 miles (73.2%) were rated as fully supporting, 1,533 miles (14.5%) were rated as partially supporting and 1,304 miles (12.3%) were rated as not supporting one or more of their designated beneficial uses (Figure I-1). For the majority of streams, the Class 2B (protected for contact recreation) was not assessed because bacteriological data were not available. Waters with this classification were only considered assessed if bacteriological data were collected unless there was physical or chemical impairment such as pH.

Assessments were based on 9,240 monitored stream miles and 1,357 evaluated stream miles (Table II-1).

Individual Use Support--Use support by individual beneficial use designations is summarized in Table II-2. The drinking water use was assessed on 3,883 miles of streams. Forty-five (45) miles were assessed as partially supporting this beneficial use and 37 miles were assessed as not supporting. Over 97%, were assessed as fully supporting. For contact recreation, 185 miles were assessed. Bacteriological samples were collected and used to assess 97 miles of streams. Eighty-four percent (84.0%) of these stream miles were supporting contact recreation. Twenty-three miles were assessed as impaired because of high pH readings.

Streams classified for agricultural use had 8,732 miles (85.2 %) that were rated as fully supporting, 484 miles (4.7%) as partially supporting and 1,028 miles (10.0 %) as not supporting agricultural usage.

The aquatic life use was assessed on 10,543 stream miles. Full use support was present on 8,868 miles (84.1%). A partial support rating was given to 1,310 miles (12.4%) and 365 miles (3.5 %) were rated as not supporting the aquatic life use support category.

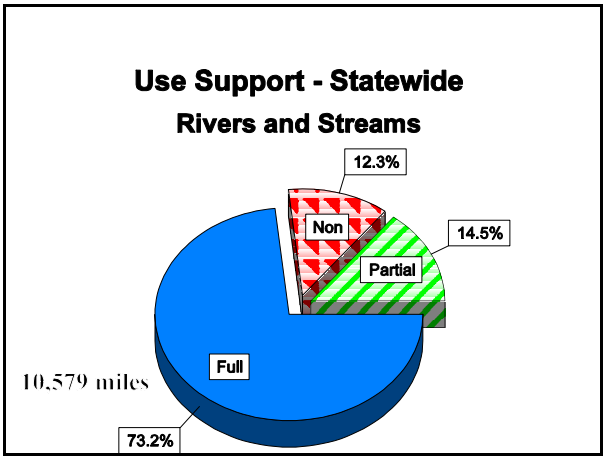

Figure II-1. Statewide use support for rivers and streams.

Figure II-2 illustrates the overall beneficial use assessment for stream segments within the state.

Categories of Data Used in Aquatic Life Use Support (ALUS) Assessments for Wadable Streams and Rivers--A summarization of ALUS categories of data used is listed in Table II-3. Physical/chemical data were the only data type used to assess 10,106 miles (96.7%) of the 10,543 miles assessed. Physical/chemical and biological/habitat data were used to assess 437 stream miles (3.4%) for aquatic life use support.

Causes of Less Than Fully Supporting-- Stream miles impacted by specific cause categories are summarized in Table II-4. Stream segments may have been impacted by multiple causes. The primary causes of impairment were total dissolved solids (13.3%), nutrients (7.8%), sediment (6.3%) and habitat alterations (6.3%)(Figure II-3). The relative percent contribution of each cause is shown in Figure II-4.Sources for Less Than Fully Supporting--The sources of stream water quality impairment are summarized in Table II-5. Like causes, stream segments may have been impacted by multiple sources. The primary sources of impairment were agricultural practices (37.0%), natural sources (20.6%) hydrological modification (16.8%), and habitat modification (12.7%) (Figure II-5). The relative percent contribution of each source for impairments are shown in Figure II-6.

Table II-1. Summary of Fully Supporting, Threatened, and Impaired Waters

Degree of Use Support	Assessment Category		Total Assessed Size (miles)
	Evaluated	Monitored	
Size Fully Supporting All Assessed Uses	1,250.0	6,503.0	7,753.0
Size Fully Supporting All Assessed Uses but Threatened for at Least One Use	-	-	-
Size Impaired for One or More Uses	107.5	2,736.8	2,844.0
TOTAL ASSESSED	1,357.0	9,240.0	10,597.0

Table II-2. Individual Use Support Summary

Goals[a]	Use	Size Assessed	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Size Not Attainable
Protect & Enhance Ecosystems	Aquatic Life	10,543.0	8,868.9 (85.2%)	0.0	1,310.6 (12.4%)	364.7 (3.5%)	0.0
Protect & Enhance Public Health	Fish Consumption	46.8	0.0	0.0	0.0	46.8 (1005)	0.0
	Swimming[b]	185.4	86.0 (46.5%)	0.0	89.6 (48.3%)	9.8 (5.2%)	0.0
	Secondary Contact	185.4	86.0 (46.5%)	0.0	89.6 (48.3%)	9.8 (5.2%)	0.0
	Drinking Water	3,883.6	3,799.9 (97.3%)	0.0	45.1 (1.2%)	38.5 (1.1%)	0.0
Social and Economic	Agricultural	10,244.1	8,732.2 (85.3%)	0.0	483.7 (4.7%)	1,026.2 (10.0%)	0.0

Table II-2. Individual Use Support Summary							
Goals[a]	**Use**	**Size Assessed**	**Size Fully Supporting**	**Size Fully Supporting but Threatened**	**Size Partially Supporting**	**Size Not Supporting**	**Size Not Attainable**
	Overall Use Support	10,597.0	7,760.9 (73.2%)	0.0	1,532.6 (14.5%)	1,303.9 (12.3%)	0.0

[a] These goals are part of the national water quality goals adopted by the EPA Office of Water and the ITFM in their Environmental Goals and Indicators effort

[b] Class 2B (secondary contact) streams were evaluated as swimmable for proposes of the CWA goals, therefore the swimming and secondary contact classification categories are the same.

Table II-3. Categories of Data Used In ALUS Assessments for Wadable Streams and Rivers				
Degree of ALUS	**Miles Assessed Based on B/H Data Only**	**Miles Assessed Based on P/C Data Only**	**Miles Assessed Based on B/H and P/C Data**	**Total Miles Assessed for ALUS**
Fully Supporting	-	8,684.2	183.9	8,868.1
Fully Supporting but Threatened	-	-	-	-
Partially Supporting	-	1,057.7	252.9	1,310.6
Not Supporting	-	364.7	0.0	364.7

Table II-4. Total Waters Impaired by Various Cause Categories (Stream Miles)		
Cause Category	**Contribution to Impairments**	
	Major	Moderate/Minor
Cause unknown	0.0	0.0
Unknown toxicity	0.0	0.0
Pesticides	-	-
Priority organics	-	-
Nonpriority organics	-	-
Metals	141.6	24.5
Ammonia	0.0	7.3
Chlorine	0.0	0.0
Other inorganics	0.0	0.0
Nutrients	101.4	734.9
pH	0.0	85.8
Siltation/Sediments	22.4	684.4
Organic enrichment/low DO	36.8	198.0
Salinity/TDS/Chlorides	947.8	456.9
Thermal modifications	161.5	151.1
Flow alterations	0.0	107.8
Other habitat alterations	0.0	663.5
Pathogen Indicators	2.5	12.9

Table II-4. Total Waters Impaired by Various Cause Categories (Stream Miles)		
Cause Category	**Contribution to Impairments**	
	Major	Moderate/Minor
Radiation	17.1	0.0
Oil and grease	-	-
Taste and odor	0.0	0.0
Noxious aquatic plants	0.0	50.6
Total toxics	-	-
Turbidity	-	-
Exotic Species	-	-

* = Category not applicable.
- = Category applicable, no data available.
0 = Category applicable, but size of waters in the category is zero.

Table I-5. Total Waters Impaired by Various Source Categories (Steam Miles)		
Source Category	**Contribution to Impairments**	
	Major	**Moderate/Minor**
Industrial Point Sources	0.0	103.8
Municipal Point Sources	30.7	99.0
Combined Sewer Overflow	0.0	0.0
Agriculture	62.0	2,346.1
Silviculture	-	-
Construction	0.0	0.0
Urban Runoff/Storm Sewers	0.0	84.8
Resource Extraction	89.4	119.4
Land Disposal	-	0.0
Hydromodification	5.7	948.2
Habitat Modification	0.0	814.9
Marinas	0.0	0.0
Atmospheric Deposition	-	-
Contaminated Sediments	-	-
Unknown Source	11.4	365.4
Natural Sources	14.2	1,357.2
Recreation	0.0	0.0
Aquaculture	0.0	144.1

* = Category not applicable.
- = Category applicable, no data available.
0 = Category applicable, but size of waters in the category is zero.

Utah Stream Beneficial Use 2002 Assessment

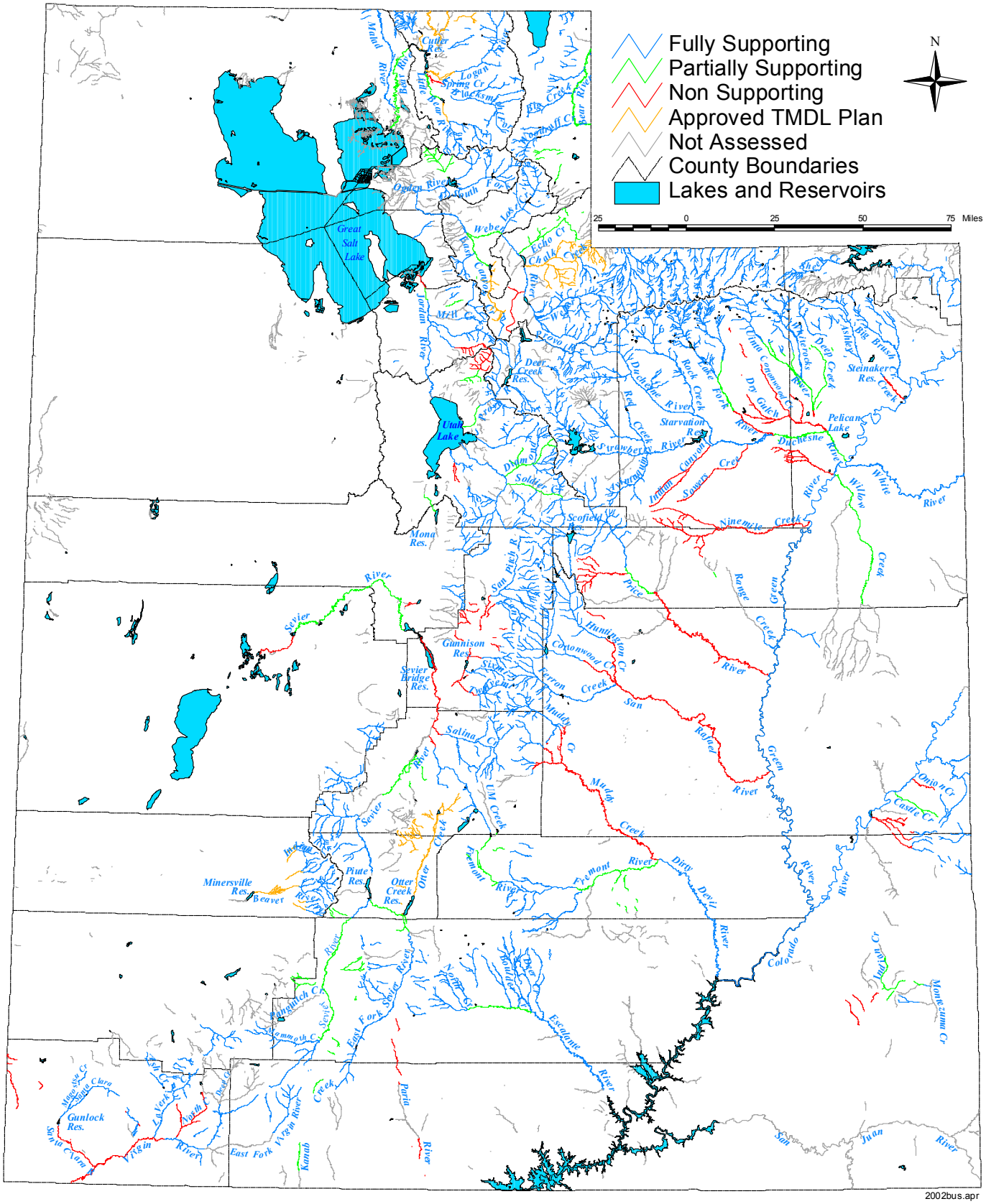

Figure II-2. Overall stream beneficial use support - 2002 305(b).

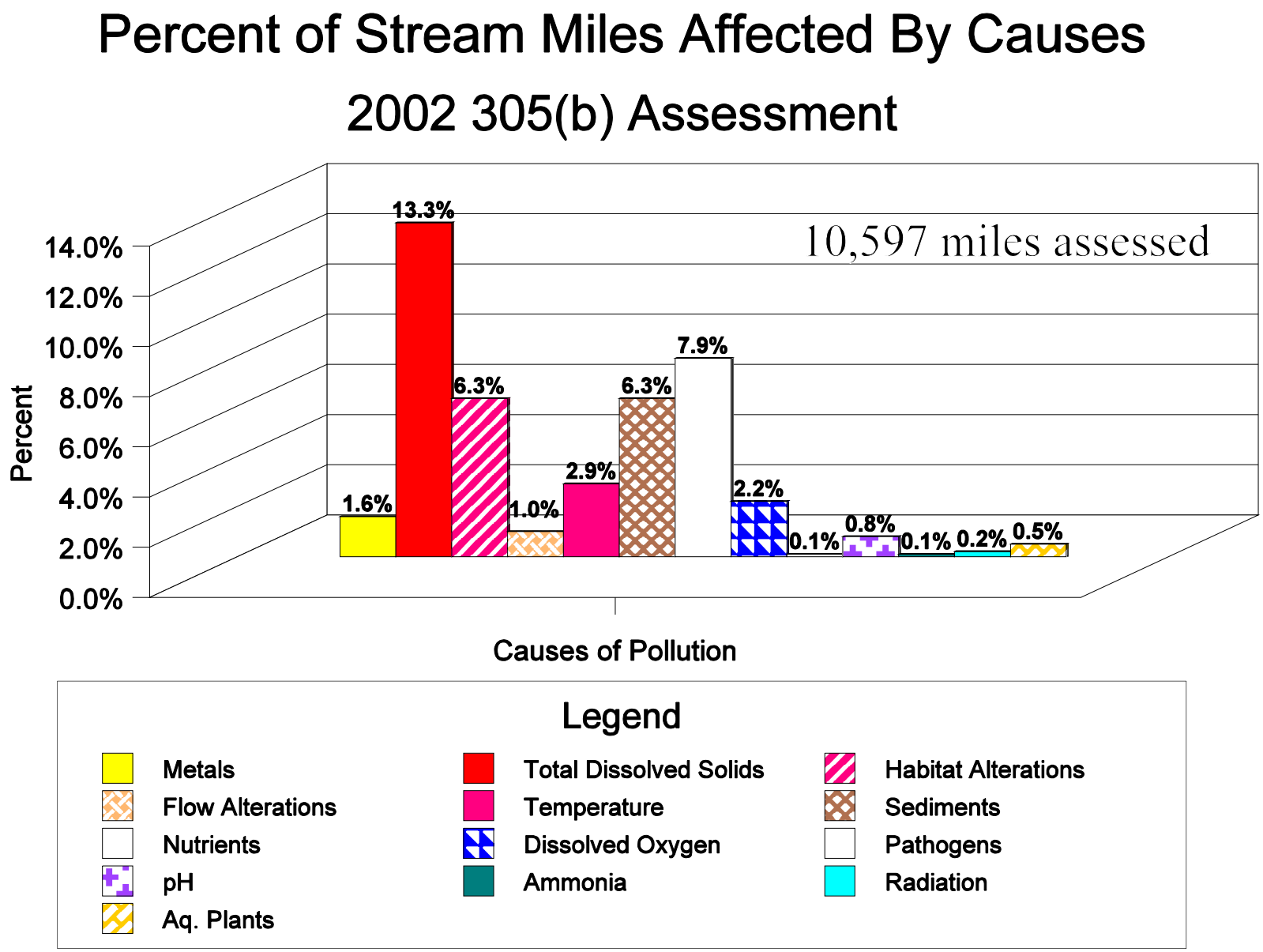

Figure II-3. Percent impact by causes on stream water quality - 2002 305(b).

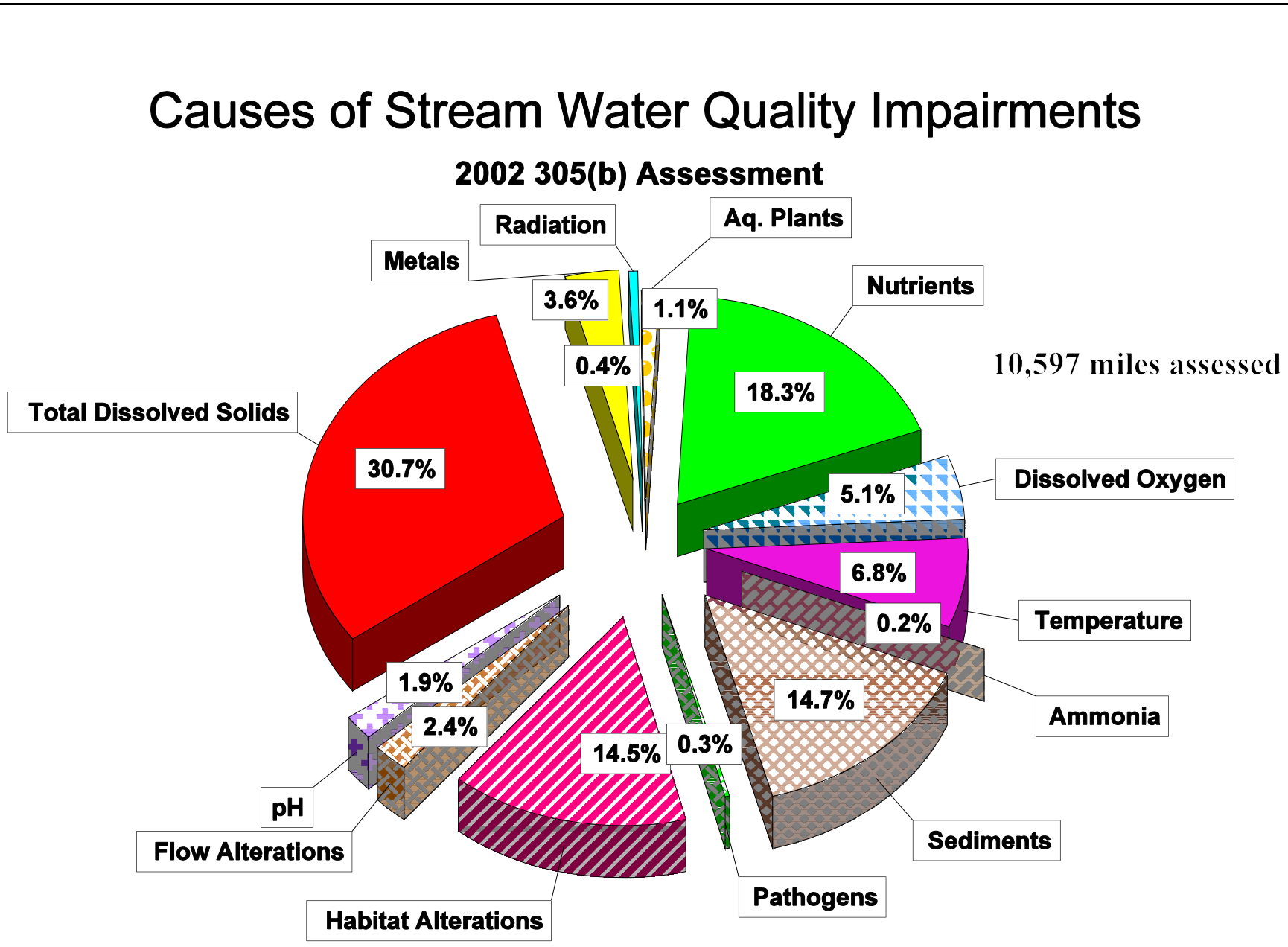

Figure II-4. Relative percent contribution of causes on stream water quality - 2002 305(b).

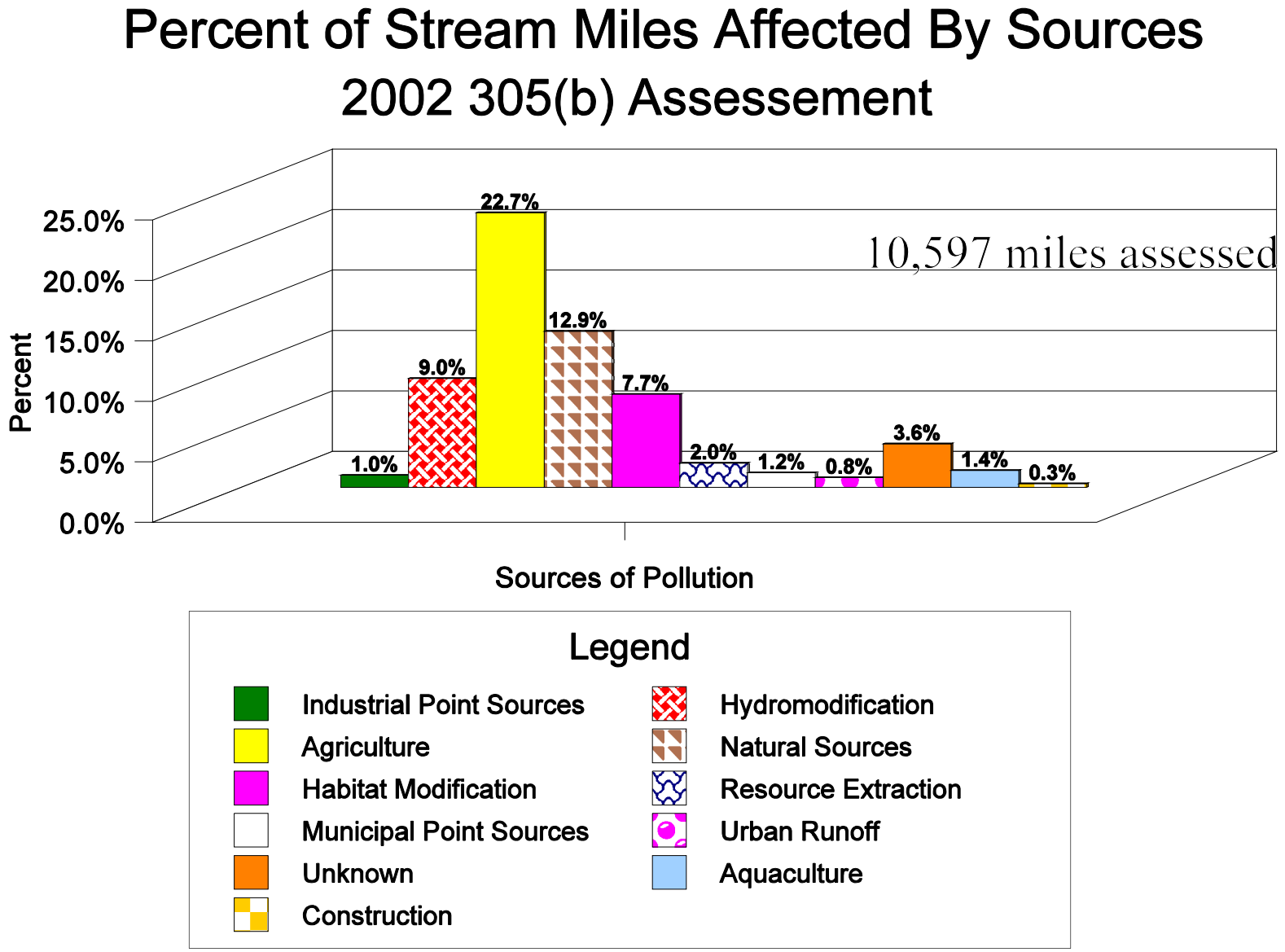

Figure II-5. Percent impact by sources on stream water quality - 2002 305(b).

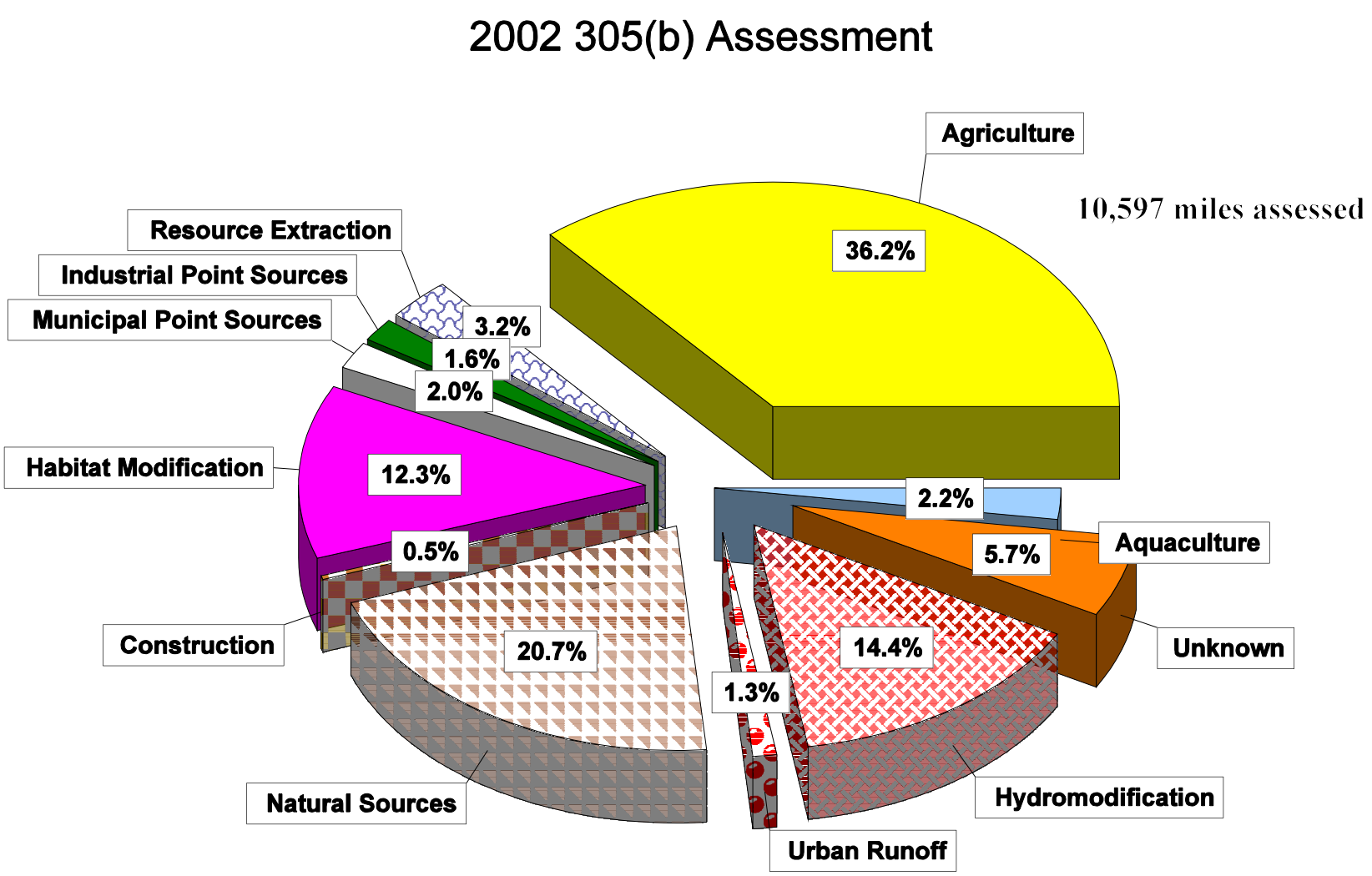

Figure II-6. Relative percent contribution of sources on stream water quality - 2002 305(b).

Chapter III: Sevier River Watershed Management Unit Assessment

Introduction

The Sevier River Watershed Management Unit includes all streams located in the U.S.G.S Hydrological Units (HUCs) listed in Table III-1 and Figure III-1 illustrates the location of the watershed management unit in the state. Some of the major streams withing unit are the Sevier River, San Pitch River, Otter Creek, Salina Creek, and the East Fork Sevier River.

Table III-1. Hydrological Unit Codes and Names

Hydrological Unit Code	Hydrological Unit Name
14030001	Upper Sevier
14030002	East Fork Sevier
14030003	Middle Sevier
14030004	San Pitch
14030005	Lower Sevier
14030009	Sevier Lake

Materials and Methods

Streams in the Sevier River Watershed Management Unit were sampled from April 1996 through June 1997. Samples were collected at 47 sites and the assessment was completed and included in the 1998 305(b) water quality assessment report to Congress. Since then, the Sevier River Watershed technical advisory group has reviewed the assessment. Because of their review, several of the waterbodies were re-defined and the assessment was done again to reflect those changes. The original data were used and the results applied to the old and new waterbodies that were defined by the advisory group.

Field and Laboratory–Forty-seven sites were monitored from April 1996 through June 1997 (Figure III-3). Samples were collected twice a month during the spring runoff period and then monthly during the remainder of the survey.

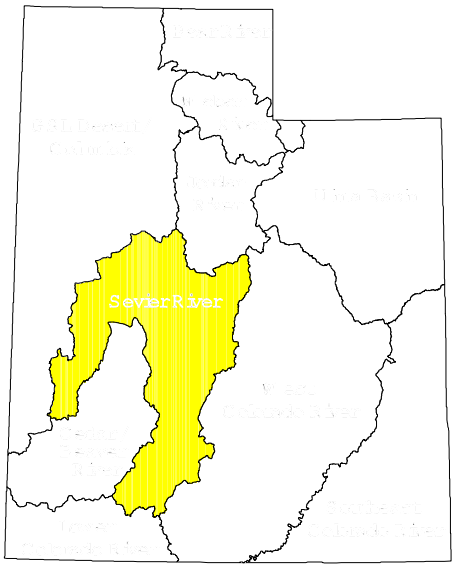

Figure III-1. Sevier River watershed location.

Samples were not collected during December 1998. Dissolved metals were collected quarterly (4 times). For the majority of monitoring sites, oxygen, pH, water temperature, and conductivity were measured *in situ* using a Hydrolab. Instantaneous flows were measured using a Marsh-McBurney flow meter during each survey unless the station was located at or near a U.S.G.S. gaging station. Water quality samples were collected according to standard field procedures defined and adopted by the Division of Water Quality in 1996 (DWQ, 1996). Chemical analysis in the laboratory included ammonia, total phosphorus, dissolved nitrate-nitrite, dissolved total phosphorus, total suspended solids, total dissolved solids, dissolved calcium, dissolved magnesium, dissolved potassium, dissolved sodium chloride concentration, sulfate, alkalinity and hardness. Turbidity was also determined in the laboratory. Concentrations for the following dissolved metals were determined: arsenic, barium, cadmium, chromium, copper, iron, lead, selenium, silver, zinc, and mercury.

Beneficial Use Assessment--Beneficial use

support assessments were made based upon the methods listed in Chapter VI, Tables VI-1 through VI-4. Water chemistry data were compared against Utah's standards listed in 'Standards of Quality for Waters of the State', R317-2, Utah Administrative Code (DWQ, 2000), to determine if the beneficial use designations for the different waterbodies were being supported. Benthic macroinvertebrate data were used as supplemental data in assessing water quality at some sites in the Sevier River drainage.

Results

Beneficial Use Assessment--There are an estimated 1,885 perennial stream miles within the Sevier River Watershed Management Unit. An assessment of beneficial use support of all beneficial uses except Class 2B (secondary contact recreation) and the small segment of Class 1C waters (Duck Creek) was made for 1,513 stream miles. Of these, 967 miles (64.0%) were assessed as fully supporting all of their beneficial uses, 393 (26.0 %) were assessed as partially supporting, and 152.0 miles (10.0 %) were assessed as not supporting at least one designated beneficial use. The overall beneficial use assessment is illustrated in Figure III-2. Individual beneficial use support is listed in Table III-2.

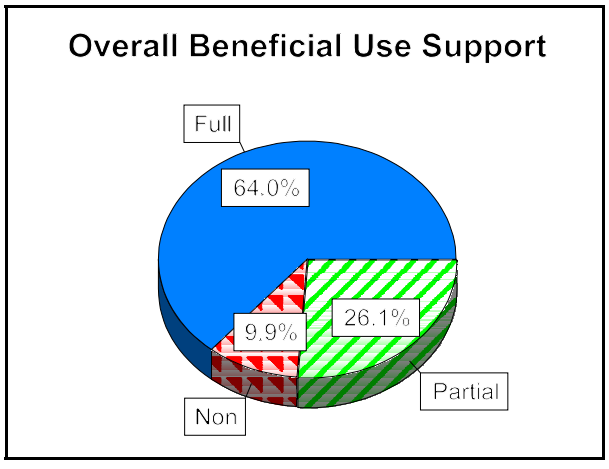

Figure III-2. Overall beneficial use support excluding Class 1C and 2B waters in Sevier River Basin.

One-thousand five-hundred six (1,513) stream miles were assessed for aquatic life and agricultural use support. This was 80.2% of the estimated stream miles that were classified for these two beneficial uses.

Of the streams assessed for aquatic life, 1,120 miles (74.0%) were assessed as fully supporting, 393.0 miles (26.0%) partially supporting this beneficial use and no miles were listed as being non supporting.

Of the streams assessed for agricultural use, 1,256 miles (83.1%) were assessed as fully supporting, 105 miles (6.9%) partially supporting, and 151.0 miles (10.0%) not supporting this beneficial use.

Those stream segments that were determined not to be supporting at least one of their designated beneficial uses are called 'water quality limited segments' and can be placed on a list called the '303(d) list of impaired waters'. This listed is submitted to EPA every two years and identifies those waters that are not meeting water quality standards or are assessed as not fully supporting one or more of their designated beneficial uses.

Figure III-3 identifies the waterbodies and the sampling sites used to assess beneficial use support. Figure III-4 shows the overall beneficial use support for the waterbody segments excluding the Class 2B and Class 1C categories. Figure III-4 also shows the designated beneficial uses assigned to the streams by the State.

The causes and sources of impairment are listed in Table III-3 and Table III-4 respectively. The major causes of impairment were nutrients (total phosphorus), sediment, habitat alterations, and total dissolved solids. The percent of miles impacted were 26.0, 24.3, 22.5 and 17.0 percent respectively (Figure III-6). The relative impact of these causes is shown in Figure III-7.

The major sources of impairment were agricultural activities, hydromodification, habitat modification, and natural as shown in Figure III-8. They affected 35.7, 34.4, 16.9, and 19.6 percent respectively of the stream miles assessed. The relative percent impairment by sources is illustrated in Figure III-9.

Table III-5 lists the stream waterbodies that were assessed as impaired, and the cause(s) and source(s) of impairment.

Sevier River–The Sevier River from Crear Lake upstream to Leamington exceeds the agriculture standard for total dissolved solids. It was assessed as not meeting the agriculture beneficial use below Gunnison Bend Reservoir and was listed as partially supporting this beneficial use from there to Leamington. From Gunnison Bend Reservoir upstream to Yuba Reservoir, the river was assessed as partially supporting the Class 3B, warm water game fish, beneficial use. This was due to excessive nutrients, sediments, and poor habitat.

From Yuba Reservoir upstream to the Salina Creek confluence, the Sevier River was assessed as not supporting its agricultural beneficial use and partially supporting the warm water game fish designation.

Several upstream segments of the Sevier River were found to be only partially supporting the agricultural and the Class 3A, cold water game fish, beneficial use classification. The stream segments not supporting the Class 3A classification included the following segments: Sevier River and tributaries from the Circleville Irrigation Diversion upstream to the Horse Valley Diversion (polygon 9, Figure III-4), from the Horse Valley Diversion upstream to the Long Canal diversion (does not all tributaries) (polygon 7), and from the Long Creek Diversion upstream to the Mammouth Creek confluence. The causes of impairment were excessive sedimentation, total phosphorus, and habitat alteration. The major sources were hydromodification and agricultural practices. Another source for total phosphorus was aquaculture (fish hatchery).

San Pitch River–The lower segments of the San Pitch River, below Gunnison Reservoir, and upstream to the U132 road crossing were assessed as not supporting the agricultural beneficial use. This was primarily due to agricultural activities and to some extent the naturally occurring saline soils and salt springs in the lower portions of the valley.

Salina Creek–The lower portion of Salina Creek had elevated levels of total dissolved solids and was determined to exceed the criteria for non support.

Lost Creek–This small stream has high TDS concentrations and contributes a significant amount of TDS to the Sevier River system. Highly saline geological formations and saline springs are located in the lower portion of Lost Creek.

East Fork Sevier River–The East Fork Sevier River was found to be supporting all of its beneficial uses with the exception of one segment. That segment runs from the confluence with the Sevier River upstream to the Antimony Creek confluence, excluding Otter Creek and its tributaries. This was due to high nutrient and sediment loads and the loss of stream habitat.

Otter Creek–Otter Creek and its tributaries were designated as partially supporting their cold water game fish classification due excessive total phosphorus, sedimentation, and habitat alteration. This stream has been designated as 319 Nonpoint Source Project and best management practices have and are being implemented in the watershed to reduce nutrient and sediment loading to improve the stream habitat. A total maximum daily load analysis

was submitted to EPA and it was approved. Because of this approval, it is not currently listed on the 303(d) list of impaired waters, but it continues to be assessed as partially supporting its Class 3A beneficial use (cold water game fish) for purposes of the 305(b) report on water quality to Congress.

Elevated Phosphorus-Figure III-5 shows those stream segments that have elevated levels of phosphorus. These segments may need further evaluation to determine if there is water quality impairment. Table III-5 contains a list of these waterbodies.

SEVIER RIVER WATERBODIES AND SAMPLING SITES

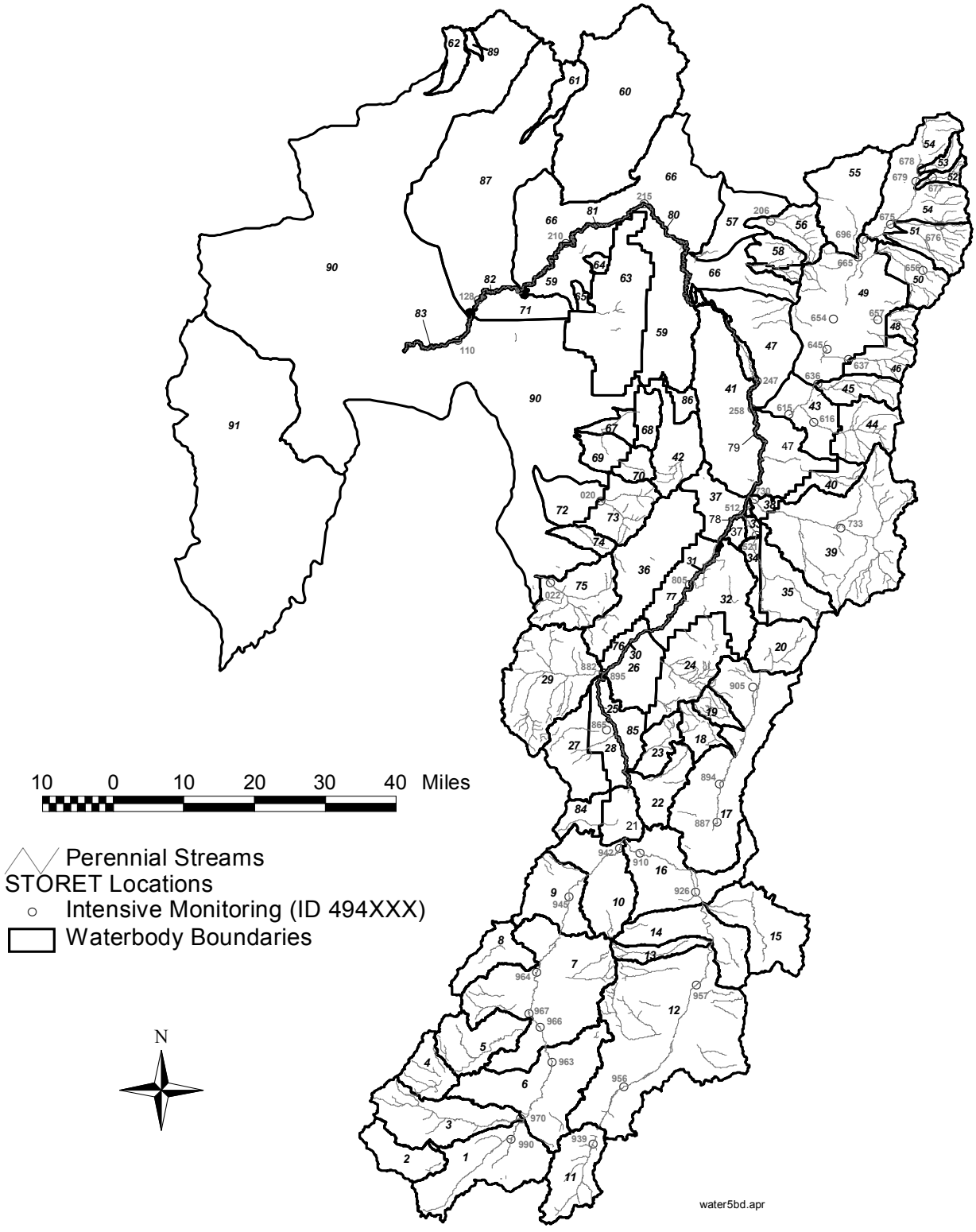

Figure III-3. Sevier River Watershed Management Unit waterbodies and sampling sites

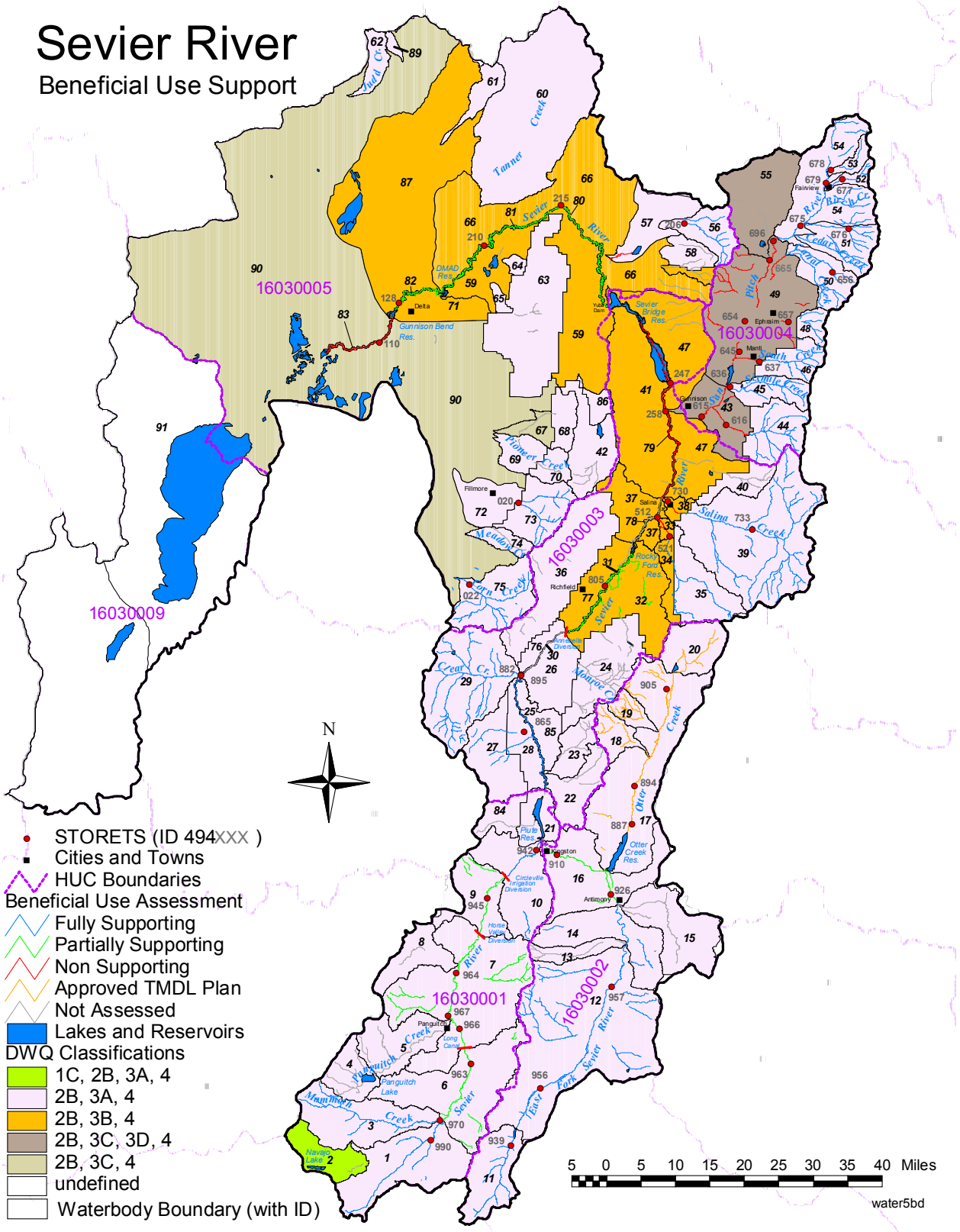

Figure III-4. Overall beneficial use support and beneficial use classifications-Sevier River watershed.

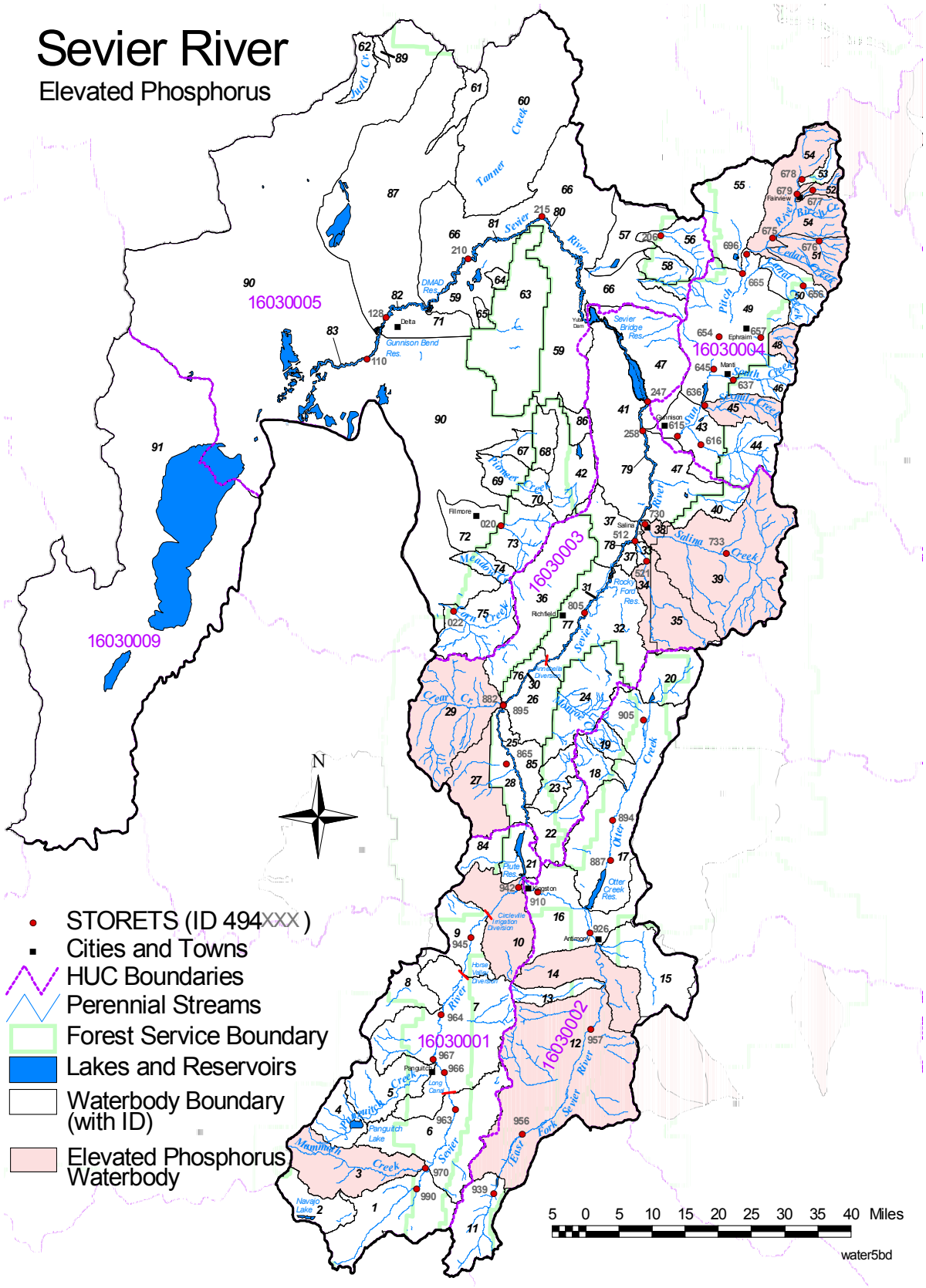

Figure III-5. Stream waterbodies with elevated levels of phosphorus-Sever River Watershed Management Unit.

Table III-2. Individual Use Support Summary for the Sevier River Watershed Management Unit (Stream Miles).							
Goals [a]	**Use**	**Size Assessed**	**Size Fully Supporting**	**Size Fully Supporting but Threatened**	**Size Partially Supporting**	**Size Not Supporting**	**Size Not Attainable**
Protect & Enhance Ecosystems	Aquatic Life	1,512.7	1,119.9 (74.0%)	0.0	393.8 (26.0%)	0.0	0.0
Protect & Enhance Public Health	Fish Consumption	0.0	0.0	0.0	0.0	0.0	0.0
	Swimming [b]	0.0	0.0	0.0	0.0	0.0	0.0
	Secondary Contact	0.0	0.0	0.0	0.0	0.0	0.0
	Drinking Water	0.0	0.0	0.0	0.0	0.0	0.0
Social and Economic	Agricultural	1,512.7	1,256.0 (83.1%)	0.0	105.2 (6.9%)	151.5 (10.0%)	0.0
	Total	1,512.7	967.0 (64.0%)	0.0	394.2 (26.1%)	151.5 (9.9%)	0.0

a - These goals are part of the national water quality goals adopted by the EPA Office of Water and the ITFM in their Environmental Goals and Indicators effort.

b - Class 2B (secondary contact) streams were evaluated as swimmable for proposes of the CWA goals, therefore the swimming and secondary contact classification categories are the same.

Table III-3. Stream Miles Impaired by Various Causes within the Sevier River Water Quality Management Unit.		
Cause Category	**Contribution to Impairments**	
	Major	**Moderate/Minor**
Cause unknown	0.0	0.0
Unknown toxicity	0.0	0.0
Pesticides	-	-
Priority organics	-	-
Nonpriority organics	-	-
Metals	0.0	0.0
Ammonia	0.0	0.0
Chlorine	0.0	0.0
Other inorganics	0.0	0.0
Nutrients	0.0	392.8
pH	0.0	0.0
Siltation/Sediments	0.0	367.5
Organic Enrichment/low DO	0.0	0.0
Salinity/TDS/Chlorides	151.5	105.2
Thermal modifications	0.0	0.0
Flow alterations	0.0	0.0
Other habitat alterations	0.0	340.4
Pathogen Indicators	-	-

Table III-3. Stream Miles Impaired by Various Causes within the Sevier River Water Quality Management Unit.		
Cause Category	**Contribution to Impairments**	
	Major	**Moderate/Minor**
Radiation	-	-
Oil and grease	0.0	0.0
Taste and odor	-	-
Noxious aquatic plants	-	-
Total toxics	0.0	0.0
Turbidity	0.0	0.0
Exotic species	-	-
Other (specify)	0.0	-

1 = Siltation / Sediment includes deposition of sediments and sources of pollutants such as phosphorus found in sediments
* = Category not applicable.
- = Category applicable, no data available.
0 = Category applicable, but size of waters in the category is zero.
Note: **Major** category is now used only for waters found not supporting.

Table III-4. Stream Miles Impaired by Various Source Categories in the Sevier River Watershed Management Unit		
Source Category	**Contribution to Impairments**	
	Major	**Moderate/Minor**
Industrial Point Sources	0.0	0.0
Municipal Point Sources	0.0	0.0
Combined Sewer Overflow	-	-
Agriculture	59.5	480.6
Silviculture	0.0	0.0
Construction	0.0	0.0
Urban Runoff/Storm Sewers	0.0	0.0
Resource Extraction	0.0	0.0
Land Disposal	0.0	0.0
Hydromodification	5.7	514.7
Habitat Modification	0.0	255.6
Marinas	-	-
Atmospheric Deposition	-	-
Contaminated Sediments	-	-
Unknown Source	0.0	0.0
Natural Sources	5.7	290.1
Reservoir Releases	0.0	0.0
Recreation	0.0	0.0
Aquaculture	0.0	113.2

* = Category not applicable.
- = Category applicable, no data available.
0 = Category applicable, but size of waters in the category is zero.
Note: Major category is now used only for waters found not supporting.

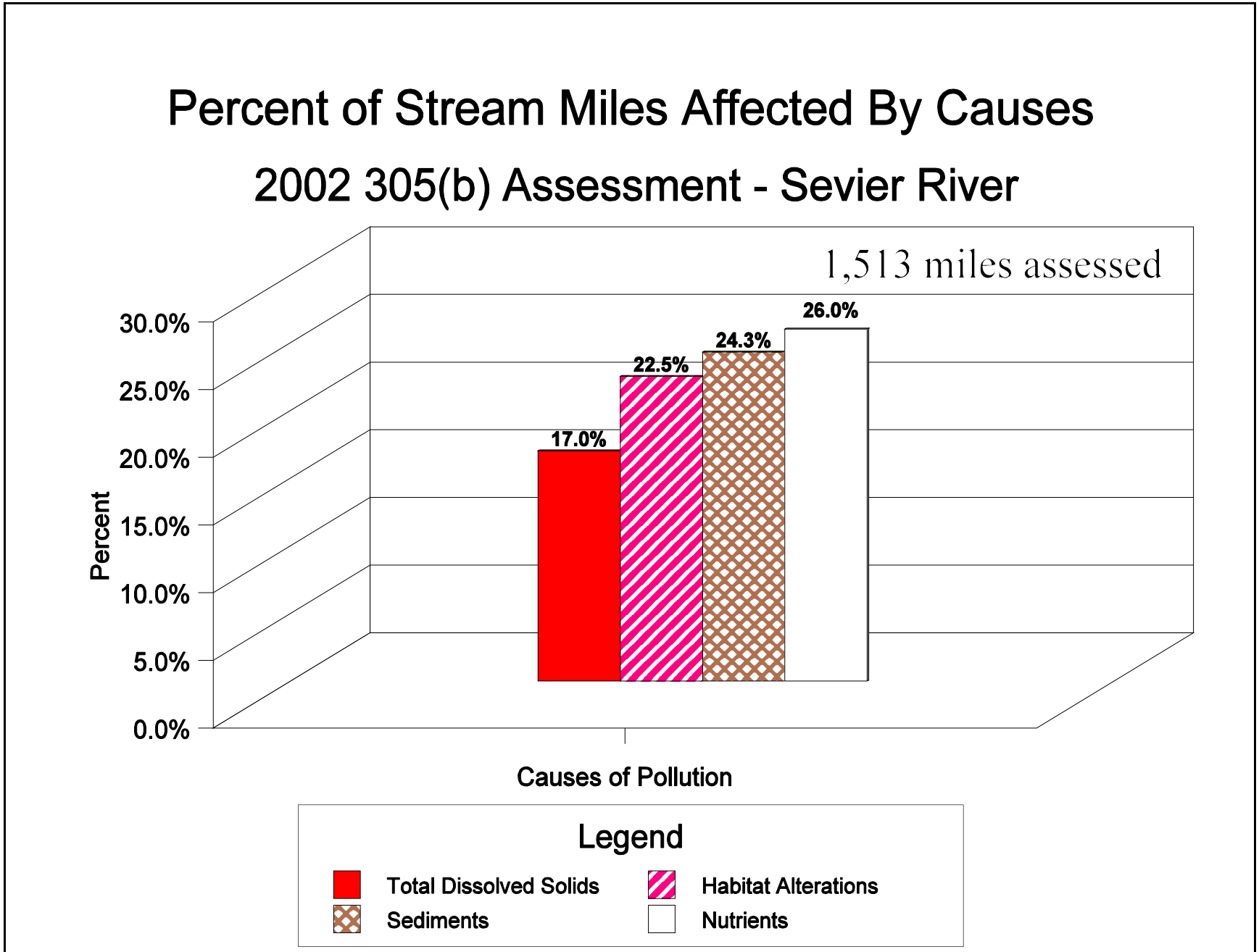

Figure III-6. Percent stream miles impacted by causes in the Sevier River Watershed Management Unit.

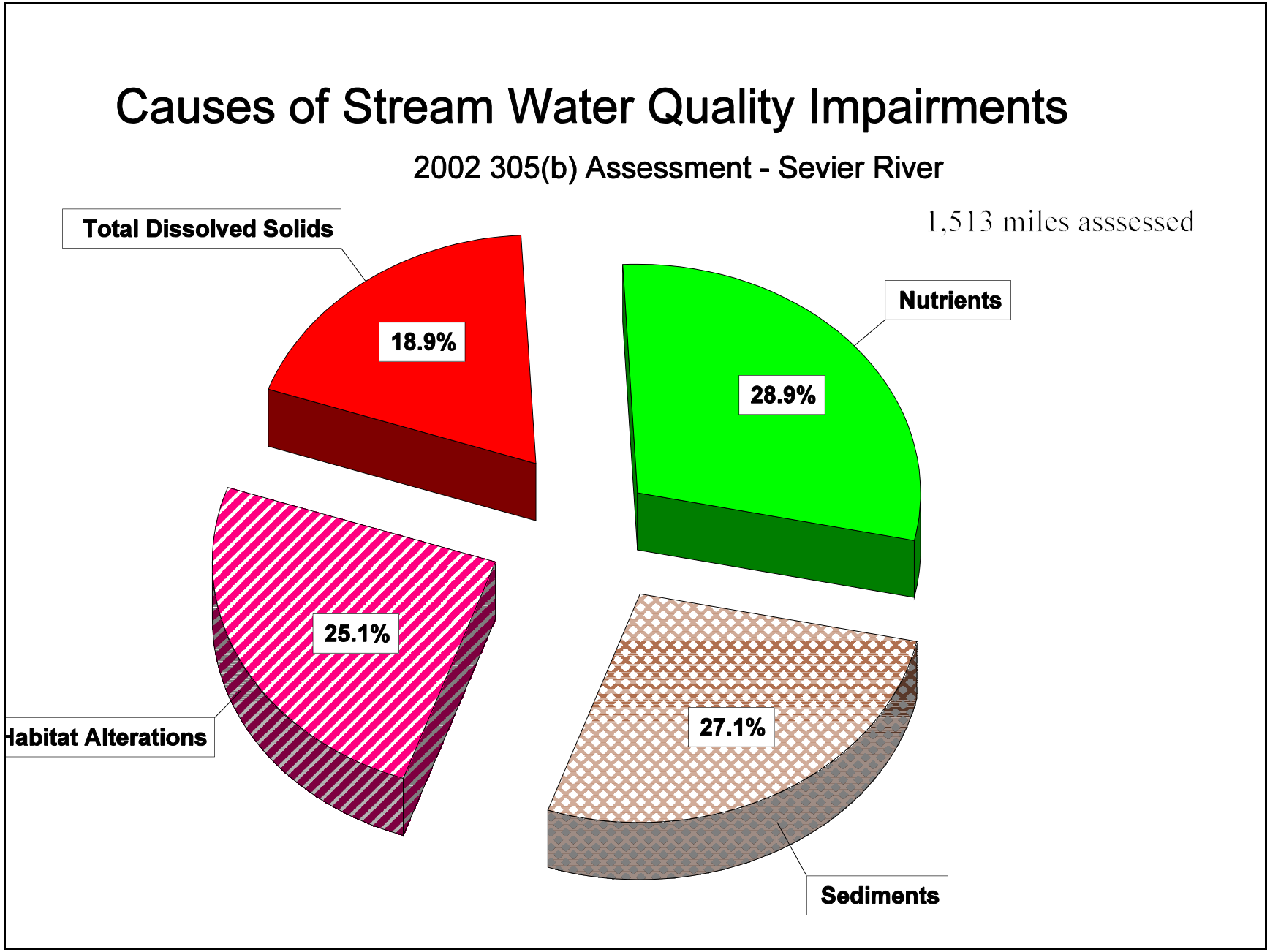

Figure III-7. Relative percent contribution by cause to impairment of stream water quality - Sevier River Watershed Management Unit.

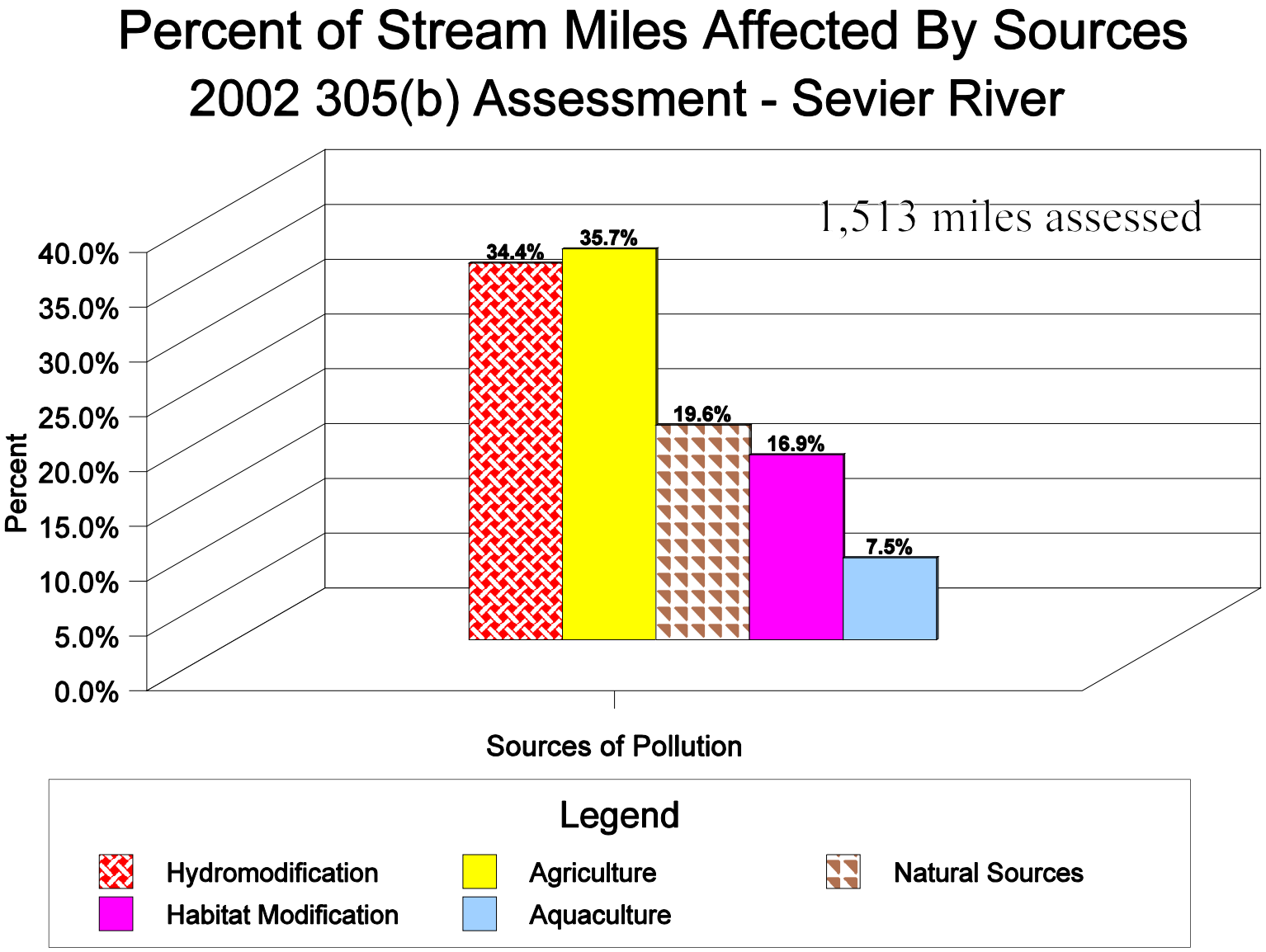

Figure III-8. Percent stream miles impacted by sources in the Sevier River Watershed Management Unit.

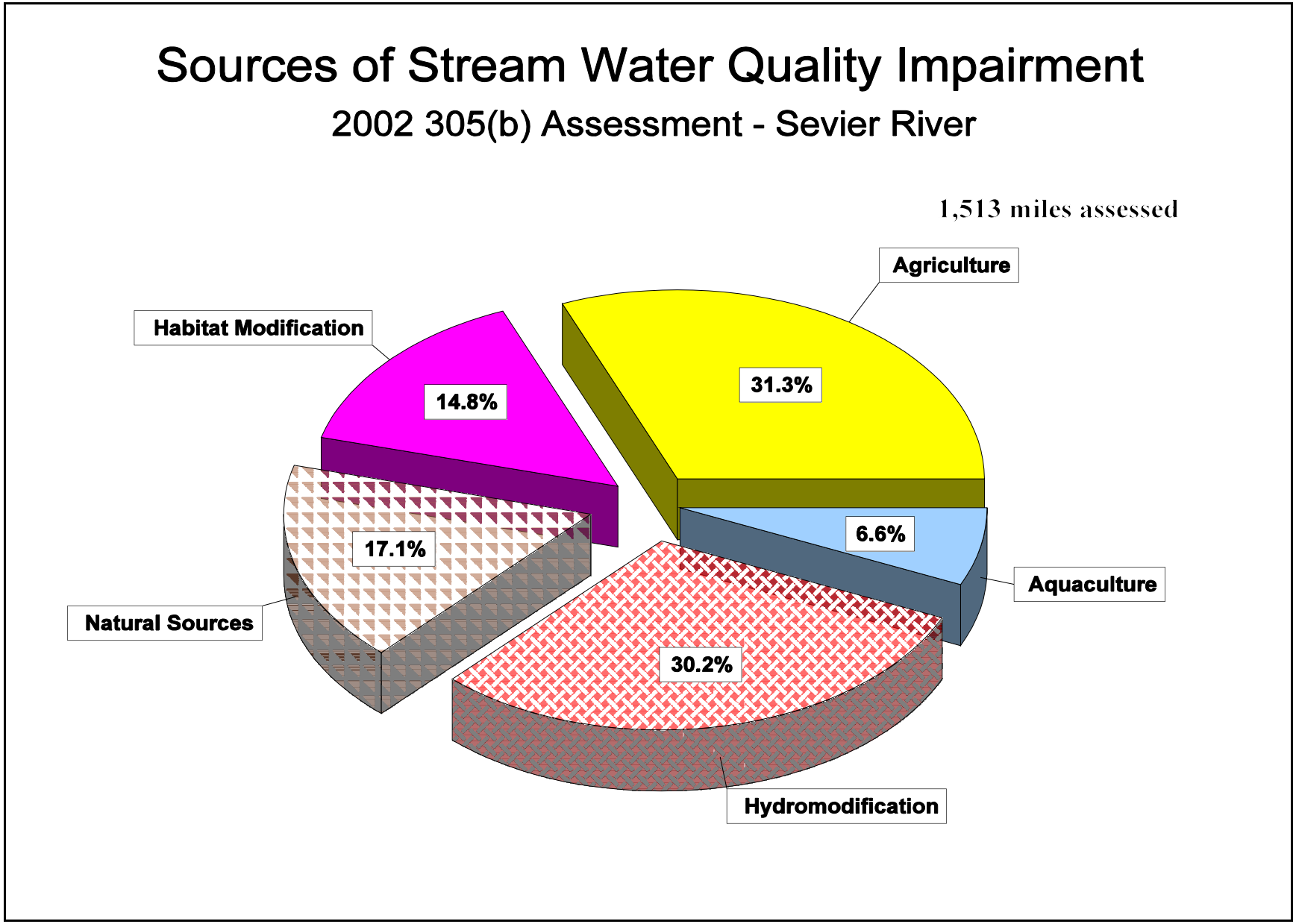

Figure III-9. Relative percent contribution by source on water quality in the Sevier River Watershed Management Unit.

Table III-5. Impaired Waterbodies in the Sevier River Watershed Management Unit.										
				Beneficial		Beneficial	Cause	Impact	Probable	Impact
WB	Waterbody	Waterbody	Waterbody	Use	Stream	Use	of	of	Source	of
No.	Name	ID	Description	Class	Miles	Support	Impairment	Cause		Source
9	Sevier River-3	UT16030001-005	Sevier River and tributaries from Circleville Irrigation Diversion upstream to Horse Valley Diversion	3A	20.38	PS	Total Phosphorus	Moderate	Agriculture	Moderate
9	Sevier River-3	UT16030001-005	Sevier River and tributaries from Circleville Irrigation Diversion upstream to Horse Valley Diversion	3A	20.38	PS	Total Phosphorus	Moderate	HydroMod	Moderate
9	Sevier River-3	UT16030001-005	Sevier River and tributaries from Circleville Irrigation Diversion upstream to Horse Valley Diversion	3A	20.38	PS	Total Phosphorus	Moderate	Aquaculture	Moderate
9	Sevier River-3	UT16030001-005	Sevier River and tributaries from Circleville Irrigation Diversion upstream to Horse Valley Diversion	3A	20.38	PS	Sediment	Moderate	Agriculture	Moderate
9	Sevier River-3	UT16030001-005	Sevier River and tributaries from Circleville Irrigation Diversion upstream to Horse Valley Diversion	3A	20.38	PS	Sediment	Moderate	HydroMod	Moderate
9	Sevier River-3	UT16030001-005	Sevier River and tributaries from Circleville Irrigation Diversion upstream to Horse Valley Diversion	3A	20.38	PS	Sediment	Moderate	HabMod	Moderate
9	Sevier River-3	UT16030001-005	Sevier River and tributaries from Circleville Irrigation Diversion upstream to Horse Valley Diversion	3A	20.38	PS	Habitat Alteration	Moderate	HabMod	Moderate
9	Sevier River-3	UT16030001-005	Sevier River and tributaries from Circleville Irrigation Diversion upstream to Horse Valley Diversion	3A	20.38	PS	Habitat Alteration	Moderate	HydroMod	Moderate
7	Sevier River-2	UT16030001-007	Sevier River and tributaries from Horse Valley Diversion upstream to Long Canal Diversion excluding Panguitch Creek, Bear Creek, and their tributaries	3A	65.71	PS	Total Phosphorus	Moderate	Agriculture	Moderate
7	Sevier River-2	UT16030001-007	Sevier River and tributaries from Horse Valley Diversion upstream to Long Canal Diversion excluding Panguitch Creek, Bear Creek, and their tributaries	3A	65.71	PS	Total Phosphorus	Moderate	HydroMod	Moderate
7	Sevier River-2	UT16030001-007	Sevier River and tributaries from Horse Valley Diversion upstream to Long Canal Diversion excluding Panguitch Creek, Bear Creek, and their tributaries	3A	65.71	PS	Total Phosphorus	Moderate	Aquaculture	Moderate
7	Sevier River-2	UT16030001-007	Sevier River and tributaries from Horse Valley Diversion upstream to Long Canal Diversion excluding Panguitch Creek, Bear Creek, and their tributaries	3A	65.71	PS	Sediment	Moderate	Agriculture	Moderate
7	Sevier River-2	UT16030001-007	Sevier River and tributaries from Horse Valley Diversion upstream to Long Canal Diversion excluding Panguitch Creek, Bear Creek, and their tributaries	3A	65.71	PS	Sediment	Moderate	HydroMod	Moderate
7	Sevier River-2	UT16030001-007	Sevier River and tributaries from Horse Valley Diversion upstream to Long Canal Diversion excluding Panguitch Creek, Bear Creek, and their tributaries	3A	65.71	PS	Habitat Alteration	Moderate	HydroMod	Moderate
6	Sevier River-1	UT16030001-012	Sevier River and tributaries from Long Canal to Mammouth Creek confluence	3A	27.12	PS	Total Phosphorus	Moderate	Agriculture	Moderate
6	Sevier River-1	UT16030001-012	Sevier River and tributaries from Long Canal to Mammouth Creek confluence	3A	27.12	PS	Total Phosphorus	Moderate	HydroMod	Moderate
6	Sevier River-1	UT16030001-012	Sevier River and tributaries from Long Canal to Mammouth Creek confluence	3A	27.12	PS	Total Phosphorus	Moderate	Aquaculture	Moderate
6	Sevier River-1	UT16030001-012	Sevier River and tributaries from Long Canal to	3A	27.12	PS	Sediment	Moderate	Agriculture	Moderate

Table III-5. Impaired Waterbodies in the Sevier River Watershed Management Unit.										
				Beneficial		Beneficial	Cause	Impact	Probable	Impact
WB	Waterbody	Waterbody	Waterbody	Use	Stream	Use	of	of	Source	of
No.	Name	ID	Description	Class	Miles	Support	Impairment	Cause		Source
			Mammouth Creek confluence							
6	Sevier River-1	UT16030001-012	Sevier River and tributaries from Long Canal to Mammouth Creek confluence	3A	27.12	PS	Sediment	Moderate	HydroMod	Moderate
20	Otter Creek-2	UT16030002-001	Otter Creek and tributaries from Koosharem Reservoir to headwaters	3B	18.28	PS	Total Phosphorus	Moderate	Agriculture	Moderate
20	Otter Creek-2	UT16030002-001	Otter Creek and tributaries from Koosharem Reservoir to headwaters	3B	18.28	PS	Sediment	Moderate	Agriculture	Moderate
20	Otter Creek-2	UT16030002-001	Otter Creek and tributaries from Koosharem Reservoir to headwaters	3B	18.28	PS	Sediment	Moderate	HydroMod	Moderate
20	Otter Creek-2	UT16030002-001	Otter Creek and tributaries from Koosharem Reservoir to headwaters	3B	18.28	PS	Sediment	Moderate	HabMod	Moderate
17	Otter Creek-1	UT16030002-002	Otter Creek and tributaries from Otter Creek Reservoir to Koosharem Reservoir (except Box and Greenwitch Creeks)	3A	56.06	PS	Total Phosphorus	Moderate	Agriculture	Moderate
17	Otter Creek-1	UT16030002-002	Otter Creek and tributaries from Otter Creek Reservoir to Koosharem Reservoir (except Box and Greenwitch Creeks)	3A	56.06	PS	Sediment	Moderate	Agriculture	Moderate
17	Otter Creek-1	UT16030002-002	Otter Creek and tributaries from Otter Creek Reservoir to Koosharem Reservoir (except Box and Greenwitch Creeks)	3A	56.06	PS	Sediment	Moderate	HydroMod	Moderate
17	Otter Creek-1	UT16030002-002	Otter Creek and tributaries from Otter Creek Reservoir to Koosharem Reservoir (except Box and Greenwitch Creeks)	3A	56.06	PS	Sediment	Moderaate	HabMod	Moderate
17	Otter Creek-1	UT16030002-002	Otter Creek and tributaries from Otter Creek Reservoir to Koosharem Reservoir (except Box and Greenwitch Creeks)	3A	56.06	PS	Habitat Alteration	Moderate	Riparian Grazing	Moderate
19	Greenwitch Creek	UT16030002-003	Greenwitch Creek and tributaries from confluence w/Otter Creek to headwaters	3A	23.48	PS	Total Phosphorus	Moderate	Agriculture	Moderate
19	Greenwitch Creek	UT16030002-003	Greenwitch Creek and tributaries from confluence w/Otter Creek to headwaters	3A	23.48	PS	Sediment	Moderate	Agriculture	Moderate
19	Greenwitch Creek	UT16030002-003	Greenwitch Creek and tributaries from confluence w/Otter Creek to headwaters	3A	23.48	PS	Sediment	Moderate	HydroMod	Moderate
19	Greenwitch Creek	UT16030002-003	Greenwitch Creek and tributaries from confluence w/Otter Creek to headwaters	3A	23.48	PS	Sediment	Moderate	HabMod	Moderate
19	Greenwitch Creek	UT16030002-003	Greenwitch Creek and tributaries from confluence w/Otter Creek to headwaters	3A	23.48	PS	Habitat Alteration	Moderate	Riparian Grazing	Moderate
18	Box Creek	UT16030002-004	Box Creek and tributaries from confluence w/Otter Creek to headwaters	3A	19.28	PS	Total Phosphorus	Moderate	Agriculture	Moderate
18	Box Creek	UT16030002-004	Box Creek and tributaries from confluence w/Otter Creek to headwaters	3A	19.28	PS	Sediment	Moderate	HydroMod	Moderate
18	Box Creek	UT16030002-004	Box Creek and tributaries from confluence w/Otter Creek to headwaters	3A	19.28	PS	Sediment	Moderate	HabMod	Moderate
18	Box Creek	UT16030002-004	Box Creek and tributaries from confluence w/Otter Creek to headwaters	3A	19.28	PS	Habitat Alteration	Moderate	Riparian Grazing	Moderate

Table III-5. Impaired Waterbodies in the Sevier River Watershed Management Unit.										
				Beneficial		Beneficial	Cause	Impact	Probable	Impact
WB	Waterbody	Waterbody	Waterbody	Use	Stream	Use	of	of	Source	of
No.	Name	ID	Description	Class	Miles	Support	Impairment	Cause		Source
16	East Fork Sevier-4	UT16030002-005	East Fork Sevier River and tributaries from confluence with Sevier River upstream to Antimony Creek confluence, excluding Otter Creek and tributaries	3A	25.32	PS	Total Phosphorus	Moderate	Agriculture	Moderate
16	East Fork Sevier-4	UT16030002-005	East Fork Sevier River and tributaries from confluence with Sevier River upstream to Antimony Creek confluence, excluding Otter Creek and tributaries	3A	25.32	PS	Total Phosphorus	Moderate	HabMod	Moderate
38	Salina Creek-1	UT16030003-003	Salina Creek and tributaries from confluence w/Sevier River to USFS boundary	4	4.15	NS	Total Dissolved Solids	Major	Agriculture	Moderate
38	Salina Creek-1	UT16030003-003	Salina Creek and tributaries from confluence w/Sevier River to USFS boundary	4	4.15	NS	Total Dissolved Solids	Major	HydroMod	Moderate
33	Lost Creek-1	UT16030003-005	Lost Creek and tributaries from confluence w/Sevier River upstream ~ 6 miles	4	5.69	NS	Total Dissolved Solids	Major	Natural	Major
33	Lost Creek-1	UT16030003-005	Lost Creek and tributaries from confluence w/Sevier River upstream ~ 6 miles	4	5.69	NS	Total Dissolved Solids	Major	HydroMod	Major
79	Sevier River-18	UT16030003-012	Sevier River from Yuba Dam upstream to the confluence with Salina Creek.	3B	43.64	PS	Total Phosphorus	Moderate	Agriculture	Moderate
79	Sevier River-18	UT16030003-012	Sevier River from Yuba Dam upstream to the confluence with Salina Creek.	3B	43.64	PS	Sediment	Moderate	Agriculture	Moderate
79	Sevier River-18	UT16030003-012	Sevier River from Yuba Dam upstream to the confluence with Salina Creek.	3B	43.64	PS	Sediment	Moderate	HydroMod	Moderate
79	Sevier River-18	UT16030003-012	Sevier River from Yuba Dam upstream to the confluence with Salina Creek.	3B	43.64	PS	Habitat Alteration	Moderate	HydroMod	Moderate
79	Sevier River-18	UT16030003-012	Sevier River from Yuba Dam upstream to the confluence with Salina Creek.	3B	43.64	PS	Habitat Alteration	Moderate	Riparian Grazing	Moderate
79	Sevier River-18	UT16030003-012	Sevier River from Yuba Dam upstream to the confluence with Salina Creek.	4	43.64	NS	Total Dissolved Solids	Major	Natural	Moderate
79	Sevier River-18	UT16030003-012	Sevier River from Yuba Dam upstream to the confluence with Salina Creek.	4	43.64	NS	Total Dissolved Solids	Major	Agriculture	Moderate
32	Sevier River-14	UT16030003-014	East side tributaries of Sevier River from Rocky ford Reservoir upstream to Annabelle Diversion and below USFS boundary	4	17.96	PS	Total Dissolved Solids	Moderate	Agriculture	Moderate
32	Sevier River-14	UT16030003-014	East side tributaries of Sevier River from Rocky ford Reservoir upstream to Annabelle Diversion and below USFS boundary	4	17.96	PS	Total Dissolved Solids	Moderate	HydroMod	Moderate

Table III-5. Impaired Waterbodies in the Sevier River Watershed Management Unit.										
				Beneficial		Beneficial	Cause	Impact	Probable	Impact
WB	Waterbody	Waterbody	Waterbody	Use	Stream	Use	of	of	Source	of
No.	Name	ID	Description	Class	Miles	Support	Impairment	Cause		Source
32	Sevier River-14	UT16030003-014	East side tributaries of Sevier River from Rocky ford Reservoir upstream to Annabelle Diversion and below USFS boundary	4	17.96	PS	Total Dissolved Solids	Moderate	Natural	Moderate
31	Sevier River-13	UT16030003-015	Sevier River from Rocky Ford Reservoir upstream to Annabelle Diversion	4	27.09	PS	Total Dissolved Solids	Moderate	Agriculture	Moderate
31	Sevier River-13	UT16030003-015	Sevier River from Rocky Ford Reservoir upstream to Annabelle Diversion	4	27.09	PS	Total Dissolved Solids	Moderate	HydroMod	Moderate
31	Sevier River-13	UT16030003-015	Sevier River from Rocky Ford Reservoir upstream to Annabelle Diversion	4	27.09	PS	Total Dissolved Solids	Moderate	Natural	Moderate
43	San Pitch-1	UT16030004-001	San Pitch River and tributaries from confluence w/Sevier River to tailwater of Gunnison Reservoir excluding tributaries above USFS boundary	4	15.82	NS	Total Dissolved Solids	Major	HydroMod	Moderate
43	San Pitch-1	UT16030004-001	San Pitch River and tributaries from confluence w/Sevier River to tailwater of Gunnison Reservoir excluding tributaries above USFS boundary	4	15.82	NS	Total Dissolved Solids	Major	Agriculture	Moderate
43	San Pitch-1	UT16030004-001	San Pitch River and tributaries from confluence w/Sevier River to tailwater of Gunnison Reservoir excluding tributaries above USFS boundary	4	15.82	NS	Total Dissolved Solids	Major	Natural	Moderate
49	San Pitch-3	UT16030004-005	San Pitch River and tributaries from Gunnison Reservoir to U132 crossing below USFS boundary	4	59.46	NS	Total Dissolved Solids	Major	Agriculture	Major
49	San Pitch-3	UT16030004-005	San Pitch River and tributaries from Gunnison Reservoir to U132 crossing below USFS boundary	4	59.46	NS	Total Dissolved Solids	Major	HydroMod	Moderate
57	Chicken Creek-2	UT16030005-022	Chicken Creek and tributaries from confluence w/Sevier River to Levan	4	4.73	NS	Total Dissolved Solids	Major	HydroMod	Moderate
57	Chicken Creek-2	UT16030005-022	Chicken Creek and tributaries from confluence w/Sevier River to Levan	4	4.73	NS	Total Dissolved Solids	Major	Natural	Moderate
57	Chicken Creek-2	UT16030005-022	Chicken Creek and tributaries from confluence w/Sevier River to Levan	4	4.73	NS	Total Dissolved Solids	Major	Agriculture	Moderate
80	Sevier River-21	UT16030005-025	Sevier River from U-132 at ther northern most point of the Sevier River (neaar Dog Valley Wash confluence) upstream to Yuba Dam.	3B	33.38	PS	Total Phosphorus	Moderate	Agriculture	Moderate
80	Sevier River-21	UT16030005-025	Sevier River from U-132 at ther northern most point of the Sevier River (neaar Dog Valley Wash confluence) upstream to Yuba Dam.	3B	33.38	PS	Sediment	Moderate	Agriculture	Moderate
80	Sevier River-21	UT16030005-025	Sevier River from U-132 at ther northern most point of the Sevier River (neaar Dog Valley Wash confluence) upstream to Yuba Dam.	3B	33.38	PS	Sediment	Moderate	HydroMod	Moderate
80	Sevier River-21	UT16030005-025	Sevier River from U-132 at ther northern most point of the Sevier River (neaar Dog Valley Wash confluence)	3B	33.38	PS	Habitat Alteration	Moderate	HydroMod	Moderate

Table III-5. Impaired Waterbodies in the Sevier River Watershed Management Unit.										
				Beneficial		Beneficial	Cause	Impact	Probable	Impact
WB	Waterbody	Waterbody	Waterbody	Use	Stream	Use	of	of	Source	of
No.	Name	ID	Description	Class	Miles	Support	Impairment	Cause		Source
			upstream to Yuba Dam.							
80	Sevier River-21	UT16030005-025	Sevier River from U-132 at ther northern most point of the Sevier River (neaar Dog Valley Wash confluence) upstream to Yuba Dam.	3B	33.38	PS	Habitat Alteration	Moderate	Riparian Grazing	Moderate
81	Sevier River-23	UT16030005-026	Sevier River from DMAD Reservoir upstream to U-132 crossing at the northern most point of the Sevier River (near Dog Valley Wash confluence)	3B	41.45	PS	Total Phosphorus	Moderate	Agriculture	Moderate
81	Sevier River-23	UT16030005-026	Sevier River from DMAD Reservoir upstream to U-132 crossing at the northern most point of the Sevier River (near Dog Valley Wash confluence)	3B	41.45	PS	Sediment	Moderate	Agriculture	Moderate
81	Sevier River-23	UT16030005-026	Sevier River from DMAD Reservoir upstream to U-132 crossing at the northern most point of the Sevier River (near Dog Valley Wash confluence)	3B	41.45	PS	Sediment	Moderate	HydroMod	Moderate
81	Sevier River-23	UT16030005-026	Sevier River from DMAD Reservoir upstream to U-132 crossing at the northern most point of the Sevier River (near Dog Valley Wash confluence)	3B	41.45	PS	Habitat Alteration	Moderate	HydroMod	Moderate
81	Sevier River-23	UT16030005-026	Sevier River from DMAD Reservoir upstream to U-132 crossing at the northern most point of the Sevier River (near Dog Valley Wash confluence)	3B	41.45	PS	Habitat Alteration	Moderate	Riparian Grazing	Moderate
81	Sevier River-23	UT16030005-026	Sevier River from DMAD Reservoir upstream to U-132 crossing at the northern most point of the Sevier River (near Dog Valley Wash confluence)	4	41.45	PS	Total Dissolved Solids	Moderate	Natural	Moderate
81	Sevier River-23	UT16030005-026	Sevier River from DMAD Reservoir upstream to U-132 crossing at the northern most point of the Sevier River (near Dog Valley Wash confluence)	4	41.45	PS	Total Dissolved Solids	Moderate	Agriculture	Moderate
82	Sevier River-25	UT16030005-027	Sevier River from Gunnison Bend Reservoir to DMAD Reservoir	3B	18.73	PS	Total Phosphorus	Moderate	Agriculture	Moderate
82	Sevier River-25	UT16030005-027	Sevier River from Gunnison Bend Reservoir to DMAD Reservoir	3B	18.73	PS	Sediment	Moderate	HydroMod	Moderate
82	Sevier River-25	UT16030005-027	Sevier River from Gunnison Bend Reservoir to DMAD Reservoir	3B	18.73	PS	Habitat Alteration	Moderate	HydroMod	Moderate
82	Sevier River-25	UT16030005-027	Sevier River from Gunnison Bend Reservoir to DMAD Reservoir	3B	18.73	PS	Habitat Alteration	Moderate	Riparian Grazing	Moderate
82	Sevier River-25	UT16030005-027	Sevier River from Gunnison Bend Reservoir to DMAD Reservoir	4	18.73	PS	Total Dissolved Solids	Moderate	Natural	Moderate
82	Sevier River-25	UT16030005-027	Sevier River from Gunnison Bend Reservoir to DMAD Reservoir	4	18.73	PS	Total Dissolved Solids	Moderate	Agriculture	Moderate
83	Sevier River-27	UT16030005-028	Sevier River from Crear Lake to Gunnison Bend Reservoir	4	17.99	NS	Total Dissolved Solids	Major	Natural	Moderate

Table III-5. Impaired Waterbodies in the Sevier River Watershed Management Unit.										
WB No.	Waterbody Name	Waterbody ID	Waterbody Description	Beneficial Use Class	Stream Miles	Beneficial Use Support	Cause of Impairment	Impact of Cause	Probable Source	Impact of Source
83	Sevier River-27	UT16030005-028	Sevier River from Crear Lake to Gunnison Bend Reservoir	4	17.99	NS	Total Dissolved Solids	Major	HydroMod	Moderate
83	Sevier River-27	UT16030005-028	Sevier River from Crear Lake to Gunnison Bend Reservoir	4	17.99	NS	Total Dissolved Solids	Major	Agriculture	Moderate

Table III-6. Waterbodies With Elevated Levels of Total Phosphorus				
Polygon No.	Waterbody Name	Waterbody ID	Waterbody Description	Stream Miles
3	Mammoth Creek	UT16030001-009	Mammoth Creek and tributaries from confluence w/Sevier River to headwaters	43.3
10	Sevier River-4	UT16030001-002	Sevier River and tributaries from Piute Reservoir to Circleville Irrigation Diversion excluding East Fork Sevier River and tributaries.	15.7
12	East Fork Sevier-2	UT16030002-009	East Fork Sevier River and tributaries from Deer Creek confluence to Tropic Reservoir	126.1
14	East Fork Sevier-3	UT16030002-006	East Fork Sevier River and tributaries from Antimony Ck confluence to Deer Creek confluence	20.8
27	Beaver Creek-2	UT16030003-020	West side tributaries to Sevier River above USFS boundary from Clear Creek upstream to HUC boundary	16.5
29	Clear Creek	UT16030003-018	Clear Creek and tributaries from confluence w/Sevier River to headwaters	100.2
34	Lost Creek-2	UT16030003-008	Lost Creek and tributaries from ~ 6 miles upstream to USFS boundary	5.2
35	Lost Creek-3	UT16030003-010	Lost Creek and tributaries from USFS boundary to headwaters	24.3
38	Salina Creek-1	UT16030003-003	Salina Creek and tributaries from confluence w/Sevier River to USFS boundary	4.2
39	Salina Creek-2	UT16030003-006	Salina Creek and tributaries from USFS boundary to headwaters	139.7
45	Six Mile Creek	UT16030004-003	Six Mile Creek and tributaries from confluence w/San Pitch River to headwaters	27.0
48	Ephraim Creek	UT16030004-007	Ephraim Creek and tributaries from USFS boundary to headwaters	13.2
51	Pleasant Creek	UT16030004-008	Pleasant Creek and Cedar Creek and their tributaries from confluence w/San Pitch River to headwaters	49.9
52	Cottonwood Creek-SP	UT16030004-013	Cottonwood Creek and tributaries from confluence w/San Pitch River to headwaters	9.3
54	San Pitch-5	UT16030004-009	San Pitch River and tributaries from U132 to Pleasant Creek confluence excluding Cedar Creek / Oak Creek / Pleasant Creek and Cottonwood Creek.	58.2

Chapter IV: Utah Lake-Jordan River Watershed Management Unit Assessment

Introduction

The Utah Lake-Jordan River Watershed Management Unit lies in north-central Utah and includes those streams that drain into Utah Lake and the Jordan River and its tributaries from Utah Lake to the Great Salt Lake. Utah Lake receives water from the Provo and Spanish Fork Rivers, and numerous tributaries that drain the Wasatch Mountains around it. In addition, the Duchesne Tunnel and Weber River diversions empty into the Provo River and a third diversion carries Strawberry Reservoir water into the lake via Diamond Fork and Spanish Fork Rivers. There are numerous streams that drain the Wasatch and Oquirrh Mountain ranges that flow into the Jordan River. Some of these streams are Little Cottonwood Creek, Big Cottonwood Creek, and Bingham Canyon Creek.

This management unit includes all streams located in the U.S.G.S Hydrological Units (HUCs) listed in Table IV-1 and is located in the north central part of the state (Figure IV-1).

Table IV-1. Hydrological Unit Codes and Names

Hydrological Unit Code	Hydrological Unit Name
16020201	Utah Lake
16020202	Spanish Fork
16020203	Provo
16020204	Jordan

Materials and Methods

Field and Laboratory–Eighty stations (Figure IV-2, Table IV-2) in the Utah Lake-Jordan River Watershed Management Unit were monitored from July 1, 1995 through June 30, 2000 by the Utah Division of Water Quality and its cooperating agencies. In addition, Salt Lake City monitored stations within the Jordan River watershed for total and fecal coliforms. Salt Lake County monitored sites on Emigration Creek for total and fecal coliforms and the U.S. Forest Service collected fish tissue samples on

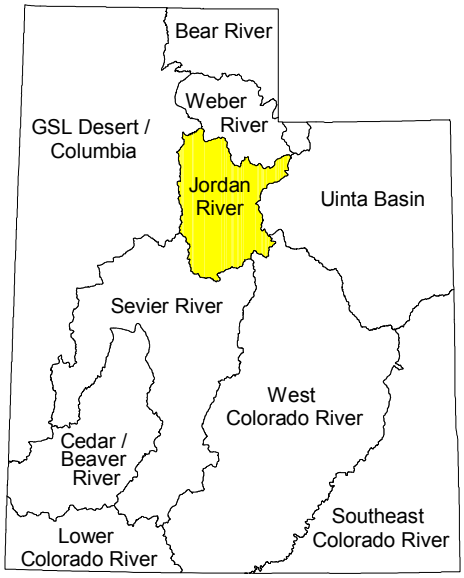

Figure IV-1. Utah Lake - Jordan River Watershed location.

the North Fork of the American Fork River. Data were also collected by the United States Geological Survey under the Great Salt Lake Basins portion of the National Water Quality Assessment Program (NAWQA).

Physical-Chemical Samples-The Division of Water Quality (DWQ) monitored physical and chemical parameters at 48 sites (Table IV-2) during the July 1, 1999 - June 30, 2000 intensive monitoring survey. These sites were monitored twice monthly during the spring run-off period and once a month during the rest of the period except for December 1999.

Data from six long term sites were also used to assess water quality. They were sampled at the same frequency as intensive sites during the intensive survey but were only sampled eight

times a year during the other years. In addition, the DWQ had cooperative agreements with Salt Lake City, the Central Utah Water Conservancy District, and the Jordanelle Technical and Advisory Committee. These cooperative agreements included the collection and processing of samples at the State Health Laboratory. Twenty-six cooperative sties were monitored. They were generally sampled monthly each year.

The following procedures were used by DWQ. Oxygen, pH, water temperature, and conductivity were measured *in situ*. Instantaneous flows were measured using a flow meters during each survey, unless the station was located at or near a U.S. Geological Survey (U.S.G.S.) gaging station. Water quality samples were collected according to standard field procedures defined and adopted by the Division of Water Quality in 1993 (DWQ, 1993). Chemical analysis in the laboratory included ammonia, total phosphorus, dissolved nitrate-nitrite, dissolved total phosphorus, total suspended solids, total dissolved solids, dissolved calcium, dissolved magnesium, dissolved potassium, dissolved sodium chloride concentration, sulfate, alkalinity and hardness. Turbidity was also determined in the laboratory. Concentrations for the following dissolved metals were determined: arsenic, barium, cadmium, chromium, copper, iron, lead, selenium, silver, zinc, and mercury. Field preservation and laboratory analysis of laboratory samples were performed according to standard procedures used by the Division of Health's State Laboratory and are EPA approved. Cooperating agencies followed guidelines in the DWQ's field procedures.

Physical and chemical data obtained from the U.S. Geological Survey were used to assess water quality in Red Butte Creek, Little Cottonwood Creek and a portion of the Jordan River near Salt Lake City. These data were collected for the Great Salt Lake Basins NAWQA Program. Data were collected from October 1998 through June 2001 on a variable basis. Sampling effort ranged from several times each month to monthly.

Benthic Macroinvertebrate Samples-Benthic macroinvertebrate data collected at 11 sites (Figure IV-2, Table IV-2) in the Spanish Fork River area and were used to assess several streams. These samples were collected and identified by Dr. Lawrence Gray, Utah Valley State College. Four surber samples (1 square foot each) were taken randomly in a transect across a riffle/run reach. Data provided to the DWQ included identifications, biomass, and graphical presentations of data.

Sediment Samples-Substrate samples were also collected by Dr. Lawrence Gray at the 11 macroinvertebrate sites. Substrates at each site were collected with a corer to a depth of 10 cm. Several cores were taken at each site and combined into one sample. Only materials pebble or smaller in size (<64 mm) were retained. After drying, the sample was sieved through a set of standard sieves into pebble, gravel, sand, and silt+clay fractions. The percent of the weight of the combined sand-silt-clay fraction to total sample weight was calculated for each sample.

Table IV-2. Benthic Macrointvertebrate Sample Sites.

Station Identification	Station Description
b1	Little Clear Creek
b2	Thistle Ck at Nebo Creek
b3	Thistle Ck at rehab site
b4	Clear Creek
b5	Starvation Creek
b6	Tie Fork Creek
b7	Lake Fork Creek
b8	Solider Ck at Mill Fork Creek
b9	Lower Soldier Creek
b10	Summit Creek
b11	Hobble Creek

Bacteriological Samples-Total and fecal

coliform samples were collected from 24 sites located in Little Cottonwood, Big Cottonwood, Mill Creek, Parleys Creek, Lambs Canyon and Emigration Canyon Creeks by the Salt Lake City Public Utilities Department (Figure IV-2, Table IV-3). Samples were usually collected weekly from April or May through October, and then monthly during the other months. Data collected in 1998, 1999, and 2000 were used to assess beneficial use for drinking water (Class 1C) and contact recreation (Class 2B) . These data were provided to the DWQ by Florence Reynolds of the Salt Lake City Department of Public Utilities.

Salt Lake County collected bacteriological samples in Emigration Canyon at five locations (Figure IV-2) from May 23 to November 7, 2001. Samples were collected at each location in the morning, at noon, and in the afternoon on a weekly basis. Steve Jensen of the Salt Lake County Public Works Department provided the data for analysis.

Table IV-3. Salt Lake City Bacteria Sampling Sites.

Station ID	Canyon	Site Name
MC1	Mill Creek	UB
MC2	Mill Creek	TOLL GATE
MC3	Mill Creek	FSB
CC1	City Creek	ABOVE GATE
CC2	City Creek	BELOW GATE
LB1	Lambs Canyon	LAMBS
PC1	Parley's Canyon	LAMBS WIER
EC1	Emigration Creek	ABOVE ROTARY
LC1	Little Cottonwood	USF BNDRY
LC3	Little Cottonwood	RED PINE
LC6	Little Cottonwood	BL SNOWB
LC8	Little Cottonwood	PERUVIAN
LC9	Little Cottonwood	SUNNYSIDE
BC1	Big Cottonwood	FS BOUNDARY
BC2	Big Cottonwood	STORM MTN
BC4	Big Cottonwood	L BLANCH
BC5	Big Cottonwood	MILL B
BC8	Big Cottonwood	JORDAN PINES
BC10	Big Cottonwood	SILVER FORK
BC12	Big Cottonwood	SOLITUDE
BC13	Big Cottonwood	BRIGHTON LP
BC14	Big Cottonwood	1ST BRDGE
BC15	Big Cottonwood	2ND BRDGE
BC16	Big Cottonwood	LST HOUSE

Fish Tissue- The Uinta National Forest collected fish tissue samples from 5 sites in the North Fork of American Fork Creek in 1999; North Fork below Tibble Fork, North Fork above Tibble Fork, North Fork above confluence with Major Evans Gulch, North Fork between Pacific Mine and Dutchman Flat, and North Fork above Pacific Mine (Figure IV-2). Four fish were collected at each site. Brown and Cutthroat trout were collected because they are a naturally reproducing species in the creek and would have the highest potential for long term exposure to contaminants. Muscle tissue samples were collected and analyzed for 21 metals by the Utah State University Toxicology Lab.

Stream Miles-Stream mile estimates for beneficial use support and miles of streams classified were calculated using 1:100,000 digital line graph (DLG) traces stored on the State's Automated Geographic Reference Center's computer and ARC/INFO. Calculations for perennial stream miles using the State's file indicated that there are 1,314 perennial stream miles in the Utah Lake-Jordan River Basin.

Data Analysis-All water quality sample data and field data collected by the DWQ and cooperating agencies were entered into the Division of Water Quality's data base and compared against the State's water quality standards for each of a river or stream's designated beneficial uses (DWQ, 2000). Data from the U.S.G.S. were analyzed using EXCEL spreadsheets and compared against State standards. Bacteriological data were provided to the State in EXCEL spreadsheets and analyses were done using this software.

Specific methods for assessing beneficial use support for the different beneficial use designations assigned to rivers and streams are listed in Chapter VI, Tables VI-1 through VI-4.

Table IV-4. Monitoring Sites and Cooperating Agencies					
STORET No.	Site Description	Agency	STORET No.	Site Description	Agency
499569	DIAMOND FORK AB MONKS HOLLOW	cuwcd	499654	MILL RACE CREEK AT I-15 CROSSING (2 MI S PROVO COURTHOUSE)	int
499571	DIAMOND FORK CREEK ABOVE SIXTH WATER CREEK	cuwcd	499686	NORTH FORK PROVO R AB SUNDANCE RESORT	int
499573	SIXTH WATER CREEK AB / DIAMOND FORK CREEK	cuwcd	499707	LAKE CK AB CNFL / TIMBER CREEK	int
499576	DIAMOND FORK AB / HAWTHORNE CAMPGROUND	cuwcd	499767	MCHENRY CREEK	int
499232	JORDAN R 1100 W 2100 S	int	499846	UPPER S FORK PROVO R AB CNFL / PROVO R	int
499254	MILL CK AB CENTRAL VALLEY WWTP AT 300W	int	591045	SNAKE CK ABOVE GOLF COURSE	int
499297	BIG COTTONWOODK CK AB JORDAN RIVER AT 500 W	int	591283	DEER CK ABOVE TIBBLE FORK RESERVOIR	int
499358	LITTLE COTTONWOOD CK AB JORDAN R AT 600 WEST	int	591352	DANIELS CK AB DEER CK RESERVOIR	int
499409	JORDAN RIVER BL 6400 S AT I 215 XING	int	591355	DANIELS CK AB FIRST DIVERSION	int
499417	JORDAN R AT 7800 S XING AB S VALLEY WWTP	int	591363	PROVO R AB CNFL / SNAKE CK AT MCKELLARS BRIDGE	int
499418	BINGHAM CK AB CNFL / JORDAN RIVER AT 1300 WEST XING	int	591976	SPRING CK AB CNFL / BEER CREEK @8400 S	int
499444	BUTTERFIELD CK AT MOUTH OF CANYON	int	591984	BEER CK AB CNFL/ SPRING CREEK @4800 W	int
499472	JORDAN RIVER AT NARROW - PUMP STATION	int	499678	PROVO RIVER AT MURDOCK DIVERSION	jtac
499498	AMERICAN FORK RIVER AT MOUTH OF CANYON	int	499681	PROVO RIVER AT OLMSTEAD DIVERSION	jtac
499512	LINDON DRAIN AT CO RD XING AB UT LAKE	int	499683	LOWER SOUTH FORK PROVO RIVER	jtac
499532	CURRANT CREEK BL MONA RES AT MOUTH OF CANYON	int	499685	N FK PROVO R AB CNFL / PROVO R AT WILDWOOD	jtac
499535	SALT CREEK AT CANYON MOUTH BL QUARRY	int	499687	LITTLE DEER CK AB CNFL / PROVO RIVER	jtac
499536	SALT CK @ USFS BNDY	int	499730	PROVO R AT MIDWAY CUTOFF RD XING N OF HEBER	jtac
499538	SALT CK AB CNFL / RED CREEK	int	499733	PROVO R AT JORDANELLE ON US40 XING	jtac
499539	HOP CREEK AB CNFL / SALT CREEK	int	499813	PROVO RIVER US89 ALT XING	jtac
499551	PETEETNEET CK AB MAPLE DELL CMPGD	int	591016	SNAKE CK AB CNFL / PROVO R @BOR GAGE	jtac
499554	SUMMIT CK (SANTAQUIN CANON AB OLD NFS BNDY	int	591321	PROVO R BL DEER CREEK RES	jtac
499558	SPANISH FORK R AB UTAH L (LAKESHORE)	int	591346	MAIN CK AB DEER CK RES AT US189 XING	jtac
499560	SPANISH FORK R AT MOARK DIVERSION	int	499088	JORDAN R AT STATE CANAL ROAD XING	lt
499564	DIAMOND FK CK AB SPANIS FK R AT US6 89 XING	int	499182	JORDAN R AT CUDAHY LANE AB S DAVIS S WWTP	lt
499580	THISTLE CK AB THISTLE LAKE	int	499460	JORDAN R AT BLUFFDALE ROAD XING	lt
499581	BENNIE CREEK .9 MILE AB / FOREST BNDRY	int	499479	JORDAN RIVER AT UTAH LAKE OUTLET	lt
499582	NEBO CREEK AT / FOREST BNDRY	int	499579	SPANISH FK R AB CNFL / DIAMOND FK CK	lt
499586	THISTLE CK AT NFS BOUNDARY	int	499840	PROVO R AB WOODLAND AT USGS GAGE NO.10154200	lt
499587	LAKE FORK AT NFS BOUNDARY	int	499195	CITY CK AB FILTRATION PLANT	slc
499588	SOLDIER CREEK AB CNFL / LAKE CREEK	int	499210	RB2 RED BUTTE CK AB RES	slc
499590	SHEEP CREEK AB CNFL / SOLDIER CREEK-FLOW ONLY	int	499214	EMIGRATION CANYON CK AT ROTARY GLEN	slc
499591	DAIRY FORK AB CNFL / SOLDIER CREEK-FLOW ONLY	int	499216	EMIGRATION CANYON CK AT SWITCHBACK	slc
499592	TIE FORK AT MOUTH	int	499217	MT DEL CK @ U65 XING BL LIL DEL	slc
499593	CLEAR CK AB CNFL SOLDIER CK	int	499219	LITTLE DEL CK@ U65 XING AB LIL DEL	slc
499594	STARVATION CK AB CNFL SOLDIER CK	int	499220	PARLEYS CANYON CK @ U65 XING AB DEL	slc
499595	SOLDIER CK AB STARVATION CK	int	499221	LAMBS CANYON CREEK BL I-80 AT WEIR	slc
499610	HOBBLE CK AT I-15 BDG 3MI S OF PROVO	int	499264	MILL CK AT USF BOUNDARY	slc
499613	LEFT FK HOBBLE CK AB RIGH FORK	int	499310	BC1 BIG COTTONWOOD CK AT USFS BOUNDARY	slc
499614	RIGHT FK HOBBLE CK @ CHERRY CMPGD	int	499366	LITTLE COTTONWOOD CK AT FORSEST BNDRY	slc
int	Division of Water Quality Intensive Monitoring Site		cuwcd	Central Utah Water Conservancy Cooperative Monitoring Site	
lt	Division of Water Quality Long term Monitoring Site		jtac	Jordannelle Technical Advisory Committee Cooperative Monitoring Ssite	
slc	Salt Lake City Cooperative Monitoring Site				

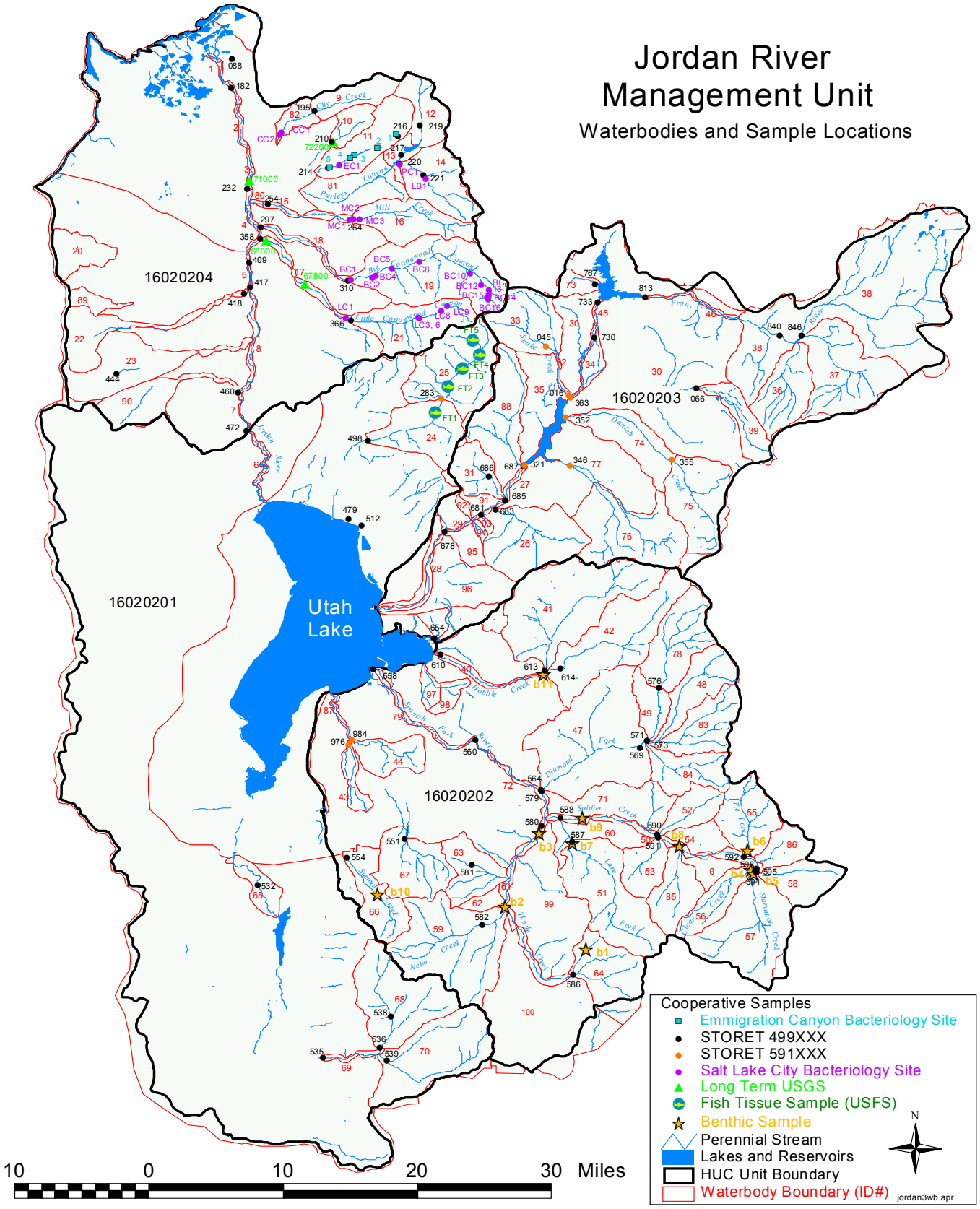

Figure IV-2. Waterbodies and sampling sites for Utah Lake - Jordan River Watershed water quality assessment.

Results

Beneficial Use Assessment-There are an estimated 1,314 perennial stream miles within the Utah Lake-Jordan River Watershed Management Unit. Some 1,025 miles (78.0%) were assessed for support of their designated beneficial uses. All stream miles designated as Class 2A (contact recreation) waters were assessed using physical/chemical data. Bacteriological data were used to assess 97 miles of streams. Only those segments where bacteriological data were collected are considered fully assessed for Class 2A waters.

Of the1,025 miles assessed, 848 (82.7%) miles were assessed as fully supporting their beneficial uses, 108 (10.6%) miles were assessed as partially supporting, and 68 (6.7%) miles were assessed as not supporting at least one designated beneficial use (Figure IV-3).

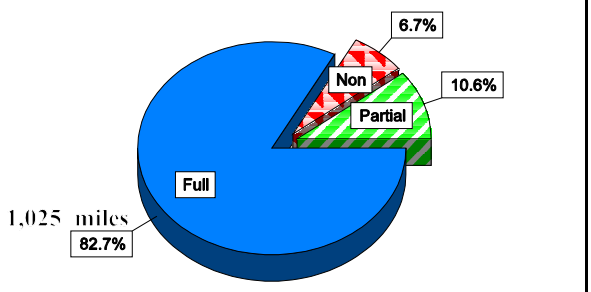

Figure IV-3. Overall use support for rivers and streams-Jordan River.

Individual beneficial use support is listed in Table IV-5.

One-thousand twenty-five (1,025) stream miles were assessed for aquatic life use support. This was 81.2% of the estimated stream miles that were classified for this beneficial use.

Of the streams assessed for aquatic life, 854 miles (83.3%) were assessed as fully supporting, 103 miles (10.0%) partially supporting this beneficial use and 68 miles (6.7%) were listed as being non supporting.

Of the 923 stream miles assessed for agricultural use, 899 miles (97.4%) were assessed as fully supporting, 24.2 miles (2.6%) were assessed as partially supporting and no stream miles were assessed as not supporting their agricultural beneficial use classification.

Those stream segments that were determined not to be supporting at least one of their designated beneficial uses are called 'water quality limited segments' and can be placed on a list called the '303(d) list of impaired waters'. This list is submitted to EPA every two years and identifies those waters that are not meeting water quality standards or are assessed as not fully supporting one or more of their designated beneficial uses.

Beneficial use designations for streams are shown in Figure IV-4 and the overall beneficial use support is shown in Figure IV-5.

The causes and sources of impairment are listed in Table IV-6 and Table IV-7 respectively. The major causes of impairment were metals, habitat alterations, flow alterations and pH. The percent of miles impacted were 5.0, 4.3, 3.2, and 2.4 percent respectively (Figure IV-6). The relative contribution of each cause to water quality impairment is shown in Figure IV-7.

The major sources of impairment were resource extraction, habitat modification, hydromodification, and agricultural activities as shown in Figure IV-8. They affected 5.0, 4.3, 3.8, and 3.8 percent respectively of the stream miles assessed. The relative percent impairment by sources is illustrated in Figure IV-9.

A description of the impaired segments and the causes and sources of impairments are listed in Table IV-8. Figure IV-6 identifies segments that have elevated levels of total phosphorus.

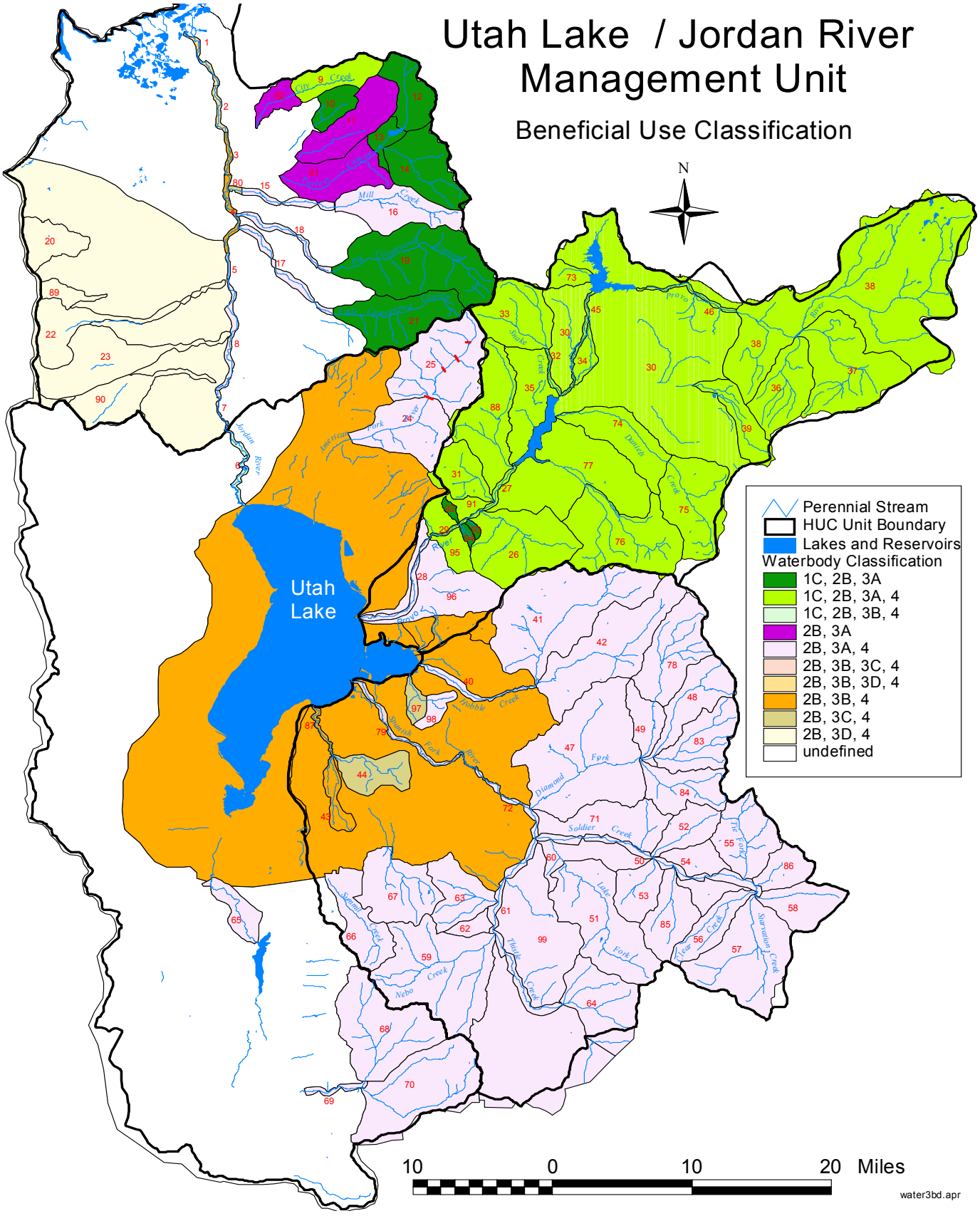

Figure IV-4. Beneficial use classification designations in the Utah Lake-Jordan River Watershed Management Unit.

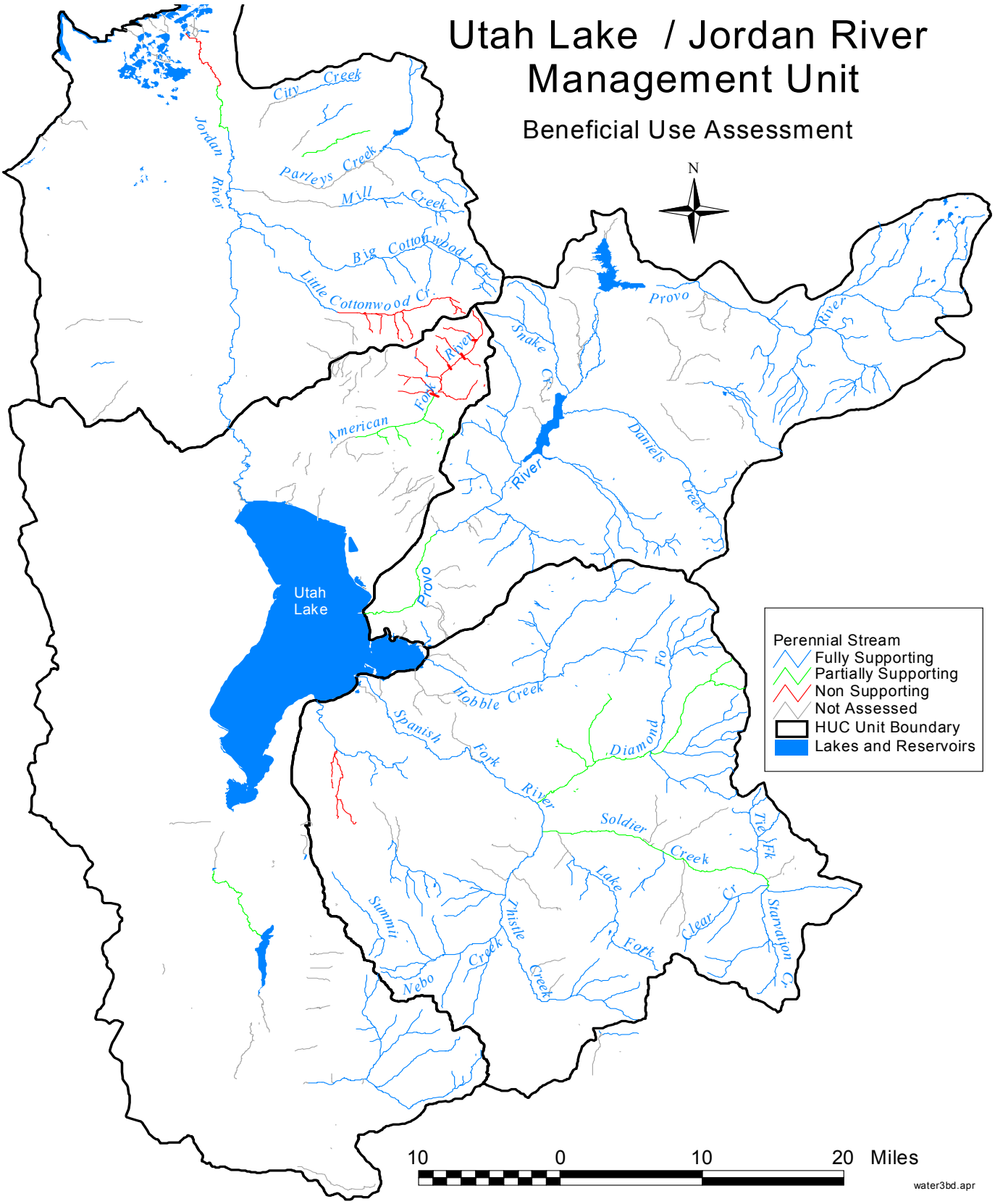

Figure IV-5. Overall beneficial use support in the Utah Lake-Jordan River Watershed Management Unit.

Jordan River - Three segments of the Jordan were assessed as not supporting at their aquatic life beneficial use support designation. Low dissolved oxygen concentration in two stream segments from Farmington Bay upstream to North Temple violated the dissolved oxygen standards for the aquatic life beneficial use and the Jordan River from Bluffdale to the Narrows exceeded the temperature standard for a Class 3A water (cold water game fish).

Urban storm-water runoff is considered a significant source of organic loading that creates a large oxygen demand in the lower parts of the Jordan River that causes the oxygen level in the stream not to meet State standards. A proposed Nonpoint Source Project, if approved, will evaluate the BOD demand from Farmington Bay upstream to Utah Lake to determine what inputs are occurring that could be causing the low dissolved oxygen concentrations in the lower portion of the river.

Emigration Creek - Emigration Creek was assessed as partially supporting its contact recreation beneficial use designation (Class 2B) after evaluating the bacteriological data provided by Salt Lake County.

Parleys Canyon Creek - Parleys Canyon Creek from 1300 East to Mountain Dell Reservoir has been assessed as not supporting its Class 3A designation because of hydromodification caused by the interstate highway. This segment is a candidate for being assigned a new beneficial use classification because of the road and the inability to correct this situation.

Mill Creek - The upper portion of Mill Creek was assessed as supporting its Class 3A beneficial use and a request to remove it was made in the 2002 303(d) list submission.

Little Cottonwood Creek - Little Cottonwood and its tributaries were assessed as being impaired by zinc in a portion of Little Cottonwood Creek upstream from the Metropolitan Waste Water Treatment Plant to headwaters. A TMDL, addressing the zinc problem, was submitted to EPA on April 1, 2002. If it is approved, this stream segment will be removed from the 303(d) list.

Big Cottonwood Creek - All segments of Big Cottonwood Creek and its tributaries were assessed as meeting their beneficial uses.

American Fork River - Based upon the fish tissue data collected by the U.S.F.S., a fish consumption advisory for arsenic was issued by the State Department of Environmental Quality, the Department of Health and the Utah County Health Department for the North Fork American Fork River upstream from Tibble Fork Reservoir (Appendix VI-2, Figure VI-1). This health advisory resulted in that portion of the river being listed as impaired. The lower portion of the American Fork River exceeded the State Standard of 9.0 for pH.

Provo River - All segments of the Provo River, with the exception of the river from Utah Lake to the Murdock Diversion, were assessed as meeting their beneficial uses. The lower segment was in violation of the pH standard. The source of this violation is unknown, but is thought to be related to algal growth in this section of the river.

Diamond Fork River - Diamond Fork River and its tributary Sixth Water Creek were determined to be impaired by flow alterations and habitat alterations. The source of these impairments is caused by hydromodification when the water is discharged from the tunnel from Strawberry Reservoir. The project to divert this water down the canyon via a pipeline to the Spanish Fork River should help alleviate these problems.

Soldier Creek - The only other segment in the Spanish Fork drainage that was assessed as

impaired was Soldier Creek from its confluence with Thistle Creek to its confluence with Starvation Creek. The impairment was caused by sediment and total phosphorus. Water chemistry data, sediment data, and benthic macroinvertebrate data collected by Dr. Lawrence Gray, was used to make this assessment. Benthic macroinvertebrate data were compared with sites on Hobble Creek, Summit Creek, and Thistle Creek to help make this determination. Graphical plots of number of taxa versus sediment particle size were also used. In addition, field surveys were made by DWQ, Natural Resource Conservation Service, and the Utah Division of Wildlife Resources to evaluate the percent of cut banks and sediment deposition. This segment was then listed under the narrative standard based upon weight of evidence.

Currant Creek - Current Creek, downstream from Mona Reservoir to the mouth of Goshen Canyon was listed as impaired because of temperature violations. The reason for these violations is not known.

All other stream segments assessed in the Utah Lake-Jordan River Watershed Management Unit were meeting the criteria for their beneficial use designations. Table VI-9 list those segments that were meeting their beneficial use standards, but because of elevated levels of phosphorus, these segments will need to be evaluated further. Through this evaluation, those needing additional work such as diurnal dissolved oxygen data, benthic macroinvertebrate data, and periphyton data will be identified.

Table IV-5. Individual Use Support Summary for the Utah Lake - Jordan River Watershed Management Unit (Stream Miles).

Goals [a]	Use	Size Assessed	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Size Not Attainable
Protect & Enhance Ecosystems	Aquatic Life	1,025.2	854.1 (83.3%)	0.0 (0.0%)	108.3. (10.0%)	68.4 (6.7%)	0.0 (0.0%)
Protect & Enhance Public Health	Fish Consumption	5.6	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)	5.6 (100%)	0.0 (0.0%)
	Swimming [b]	111.5	81.7 (73.3%)	0.0 (0.0%)	29.8 (26.7%)	0.0 (0.0%)	0.0 (0.0%)
	Secondary Contact	111.5	81.7 (73.3%)	0.0 (0.0%)	29.8 (26.7%)	0.0 (0.0%)	0.0 (0.0%)
	Drinking Water	402.6	402.6 (100%)	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)
Social and Economic	Agricultural	923.2	899.0 (97.4%)	0.0 (0.0%)	24.0 (2.6%)	0.0 (0.0%)	0.0 (0.0%)
	Total	1,025.4	848.5 (82.7%)	0.0 (0.0%)	108.3 (10.6%)	68.4 (6.7%)	0.0 (0.0%)

a - These goals are part of the national water quality goals adopted by the EPA Office of Water and the ITFM in their Environmental Goals and Indicators effort.

b - Class 2B (secondary contact) streams were evaluated as swimmable for proposes of the CWA goals, therefore the swimming and secondary contact classification categories are the same.

Table IV-6. Stream Miles Impaired by Various Causes within the Utah Lake - Jordan River Water Quality Management Unit.		
Cause Category	**Contribution to Impairments**	
	Major	**Moderate/Minor**
Cause unknown	0.0	0.0
Unknown toxicity	0.0	0.0
Pesticides	-	-
Priority organics	-	-
Nonpriority organics	-	-
Metals	50.9	0.0
Ammonia	0.0	0.0
Chlorine	0.0	0.0
Other inorganics	0.0	0.0
Nutrients	0.0	18.5
pH	0.0	24.2
Siltation/Sediments	0.0	18.5
Organic Enrichment/low DO	6.1	4.5
Salinity/TDS/Chlorides	0.0	0.0
Thermal modifications	11.4	11.7
Flow alterations	0.0	32.4
Other habitat alterations	0.0	43.7
Pathogen Indicators	0.0	5.6
Radiation	-	-
Oil and grease	0.0	0.0
Taste and odor	-	-
Noxious aquatic plants	-	-
Total toxics	0.0	0.0
Turbidity	0.0	0.0
Exotic species	-	-
Other (specify)	0.0	0.0

* = Category not applicable.
- = Category applicable, no data available.
0 = Category applicable, but size of waters in the category is zero.

Table IV-7. Stream Miles Impaired by Various Source Categories in the Utah Lake-Jordan River Watershed Management Unit		
Source Category	**Contribution to Impairments**	
	Major	**Moderate/Minor**
Industrial Point Sources	0.0	10.6
Municipal Point Sources	0.0	10.6
Combined Sewer Overflow	-	-
Agriculture	0.0	38.5
Silviculture	0.0	0.0
Construction	0.0	0.0
Urban Runoff/Storm Sewers	0.0	5.6
Resource Extraction	50.9	0.0
Land Disposal	0.0	0.0
Hydromodification	0.0	38.5
Habitat Modification	0.0	43.7
Marinas	-	-
Atmospheric Deposition	-	-
Contaminated Sediments	-	-

Table IV-7. Stream Miles Impaired by Various Source Categories in the Utah Lake-Jordan River Watershed Management Unit		
Source Category	**Contribution to Impairments**	
	Major	**Moderate/Minor**
Unknown Source	11.4	35.9
Natural Sources	5.6	5.6
Reservoir Releases	0.0	0.0
Recreation	0.0	0.0

* = Category not applicable.
- = Category applicable, no data available.
0 = Category applicable, but size of waters in the category is zero.
Note: Major category is now used only for waters found not supporting.

Table IV-8. Impaired Stream Segments in the Utah Lake - Jordan River Watershed										
					Beneficial	Beneficial		Impact		Impact
Polygon	Waterbody			Stream	Use	Use		of		of
No	ID	Name	Description	Miles	Class	Support	Cause	Cause	Source	Source
24	UT16020201-001	American Fork River-1	American Fork River and tributaries from Diversion at mouth of Canyon to Tibble Fork Res	14.0	2B	PS	pH	Moderate	Unknown	Moderate
24	UT16020201-001	American Fork River-1	American Fork River and tributaries from Diversion at mouth of Canyon to Tibble Fork Res	14.0	3A	PS	pH	Moderate	Unknown	Moderate
24	UT16020201-001	American Fork River-1	American Fork River and tributaries from Diversion at mouth of Canyon to Tibble Fork Res	14.0	4	PS	pH	Moderate	Unknown	Moderate
25	UT16020201-002	American Fork River-2	American Fork River and other tributaries above Tibble Fork Dam	30.8	3A	NS	Arsenic	Moderate	Resource Extraction	Major
65	UT16020201-003	Currant Creek	Current Creek from mouth of Gohsen Canyon to Mona Reservoir	7.6	3A	PS	Temperature	Moderate	Unknown	Moderate
47	UT16020202-006	Diamond Fork-1	Diamond Fork Creek from confluence w/ Spanish Fork River to Sixth Water confluence-tribs	20.0	3A	PS	Riparian Habitat Alteration	Moderate	Hydromodification	Moderate
47	UT16020202-006	Diamond Fork-1	Diamond Fork Creek from confluence w/ Spanish Fork River to Sixth Water confluence-tribs	20.0	3A	PS	Riparian Habitat Alteration	Moderate	Habitat Modification	Low
47	UT16020202-006	Diamond Fork-1	Diamond Fork Creek from confluence w/ Spanish Fork River to Sixth Water confluence-tribs	20.0	3A	PS	Riparian Habitat Alteration	Moderate	Agriculture	Low
47	UT16020202-006	Diamond Fork-1	Diamond Fork Creek from confluence w/ Spanish Fork River to Sixth Water confluence-tribs	20.0	3A	PS	Flow Alteration	Moderate	Hydromodification	Moderate
47	UT16020202-006	Diamond Fork-1	Diamond Fork Creek from confluence w/ Spanish Fork River to Sixth Water confluence-tribs	20.0	3A	PS	Stream Habitat Alteration	Moderate	Hydromodification	Moderate
48	UT16020202-009	Sixth Water Creek	Sixth Water Creek and tributaries from confluence w/ Diamond Fork Creek to headwaters	13.4	3A	PS	Habitat Alteration	Moderate	Habitat Modification	Moderate
48	UT16020202-009	Sixth Water Creek	Sixth Water Creek and tributaries from confluence w/ Diamond Fork Creek to headwaters	13.4	3A	PS	Habitat Alteration	Moderate	Hydromodification	Moderate
48	UT16020202-009	Sixth Water Creek	Sixth Water Creek and tributaries from confluence w/ Diamond Fork Creek to headwaters	13.4	3A	PS	Flow Alteration	Moderate	Hydromodification	Moderate
50	UT16020202-012	Soldier Creek-1	Soldier Creek from confluence with Thistle Creek to confluence of Starvation Creek	18.5	3A	PS	Sediment	Moderate	Agriculture	Moderate
50	UT16020202-012	Soldier Creek-1	Soldier Creek from confluence with Thistle Creek to confluence of Starvation Creek	18.5	3A	PS	Sediment	Moderate	Hydromodification	Moderate

Table IV-8. Impaired Stream Segments in the Utah Lake - Jordan River Watershed										
Polygon No	Waterbody ID	Name	Description	Stream Miles	Beneficial Use Class	Beneficial Use Support	Cause	Impact of Cause	Source	Impact of Source
50	UT16020202-012	Soldier Creek-1	Soldier Creek from confluence with Thistle Creek to confluence of Starvation Creek	18.5	3A	PS	Total Phosphorus	Moderate	Agriculture	Moderate
50	UT16020202-012	Soldier Creek-1	Soldier Creek from confluence with Thistle Creek to confluence of Starvation Creek	18.5	3A	PS	Total Phosphorus	Moderate	Hydromodification	Moderate
43	UT16020202-026	Spring Creek	Spring Creek and tributaries from confluence w/ Beer Creek to headwaters	11.4	3A	NS	Temperature	Major	Unknown	Major
28	UT16020203-001	Provo River-1	Provo River from Utah Lake to Murdock Diversion	10.2	2B	PS	pH	Moderate	Unknown	Moderate
28	UT16020203-001	Provo River-1	Provo River from Utah Lake to Murdock Diversion	10.2	3A	PS	pH	Moderate	Unknown	Moderate
28	UT16020203-001	Provo River-1	Provo River from Utah Lake to Murdock Diversion	10.2	4	PS	pH	Moderate	Unknown	Moderate
1	UT16020204-001	Jordan River-1	Jordan River from Farmington Bay upstsream 6.3 miles	6.1	3C	NS	Dissolved Oxygen	Major	Municipal Discharge	Moderate
1	UT16020204-001	Jordan River-1	Jordan River from Farmington Bay upstsream 6.3 miles	6.1	3C	NS	Dissolved Oxygen	Major	Urban Runoff	Moderate
1	UT16020204-001	Jordan River-1	Jordan River from Farmington Bay upstsream 6.3 miles	6.1	3C	NS	Dissolved Oxygen	Major	Industrial Discharge	Moderate
2	UT16020204-002	Jordan River-2	Jordan River from 6.3 miles upstream to North Temple	4.5	3B	PS	Dissolved Oxygen	Moderate	Municipal Discharge	Moderate
2	UT16020204-002	Jordan River-2	Jordan River from 6.3 miles upstream to North Temple	4.5	3B	PS	Dissolved Oxygen	Moderate	Urban Runoff	Moderate
2	UT16020204-002	Jordan River-2	Jordan River from 6.3 miles upstream to North Temple	4.5	3B	PS	Dissolved Oxygen	Moderate	Industrial Discharge	Moderate
7	UT16020204-007	Jordan River-7	Jordan River from Bluffdale to Narrows	4.1	3A	PS	Temperature	Moderate	Unknown	Moderate
11	UT16020204-012	Emigration Creek	Emigration Creek and tributaries from Foothill BLVD to headwaters	5.6	2B	PS	Fecal Coliforms	Major	Septic Systems	Moderate
11	UT16020204-012	Emigration Creek	Emigration Creek and tributaries from Foothill BLVD to headwaters	5.6	2B	PS	Fecal Coliforms	Major	Wildlife	Moderate
21	UT16020204-022	Little Cottonwood Creek-2	Little Cottonwood Creek and tributaries form Metropolitan WTP to headwaters	20.1	3A	NS	Zinc	Major	Resource Extraction	Major
81	UT16020204-025	Parley Canyon Creek-1	Parley's Canyon Creek and tributaries from 1300 East to Mountain Dell Reservoir	11.4	3C	PS	Habitat Alteration	Moderate	Habitat Modification	Habitat Modification

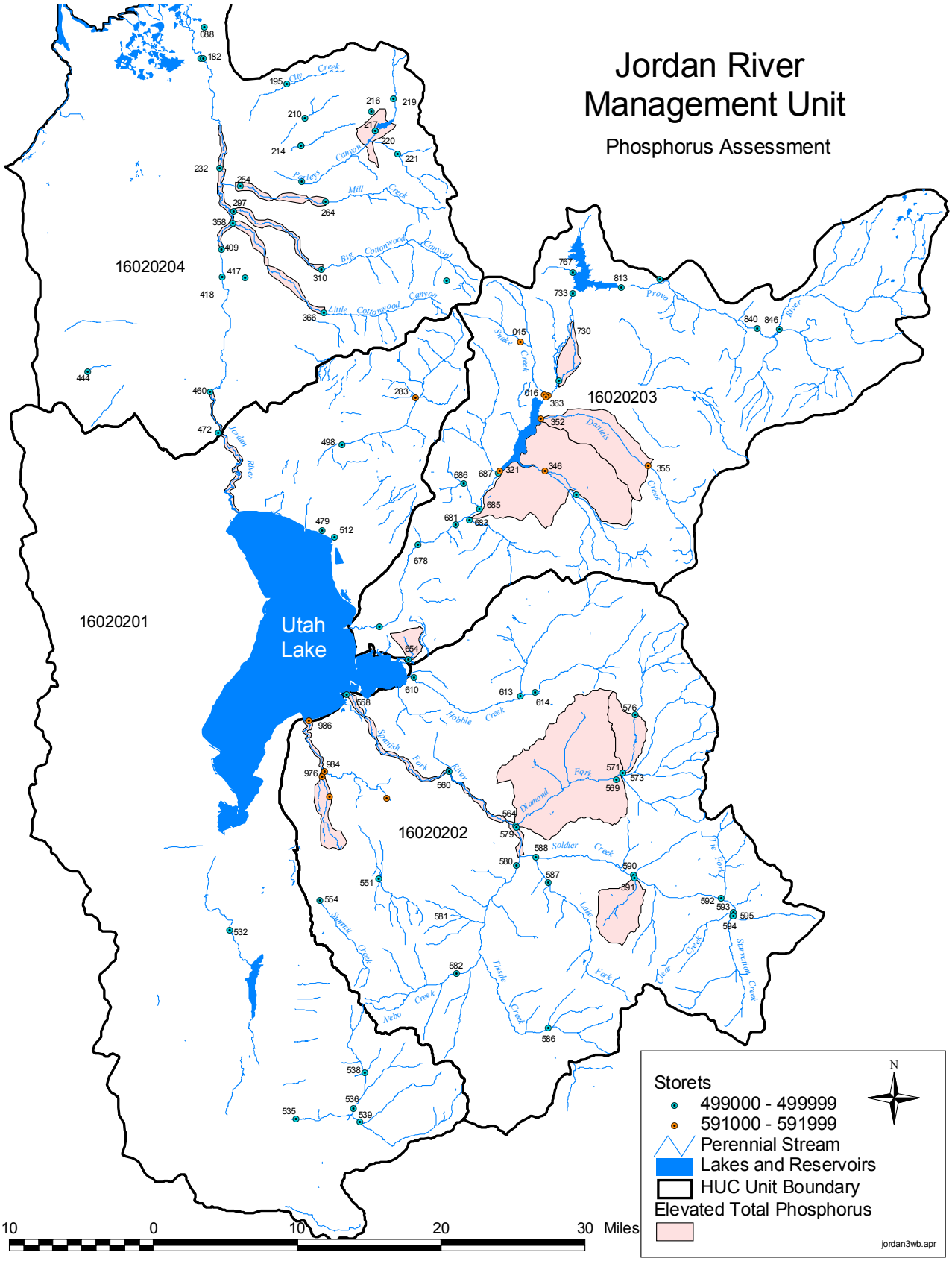

Figure IV-6. Waterbodies with elevated total phosphorus-Utah Lake Jordan River.

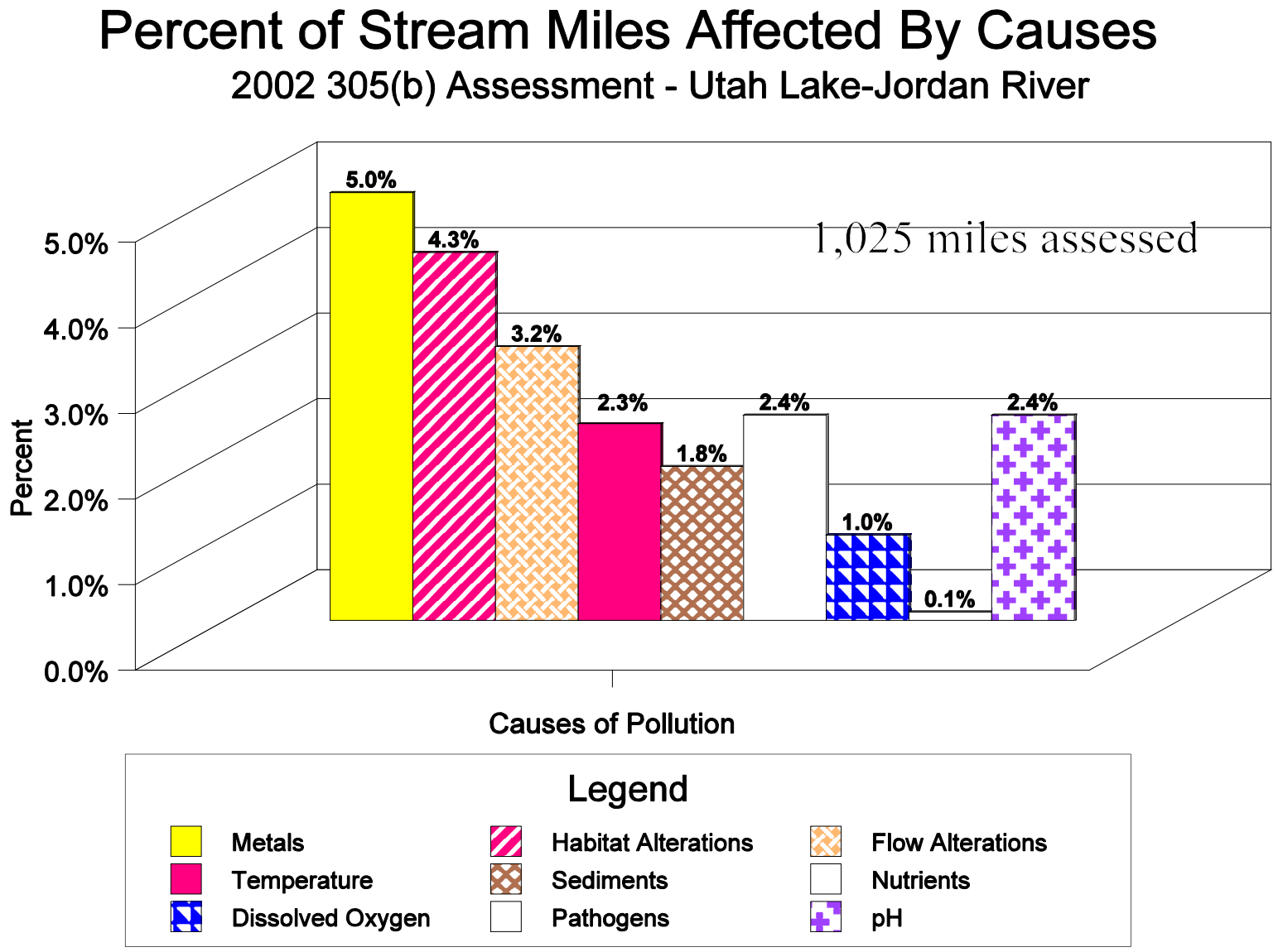

Figure IV-7. Percent of assessed miles impacted by causes - Utah Lake-Jordan River Watershed Management Unit.

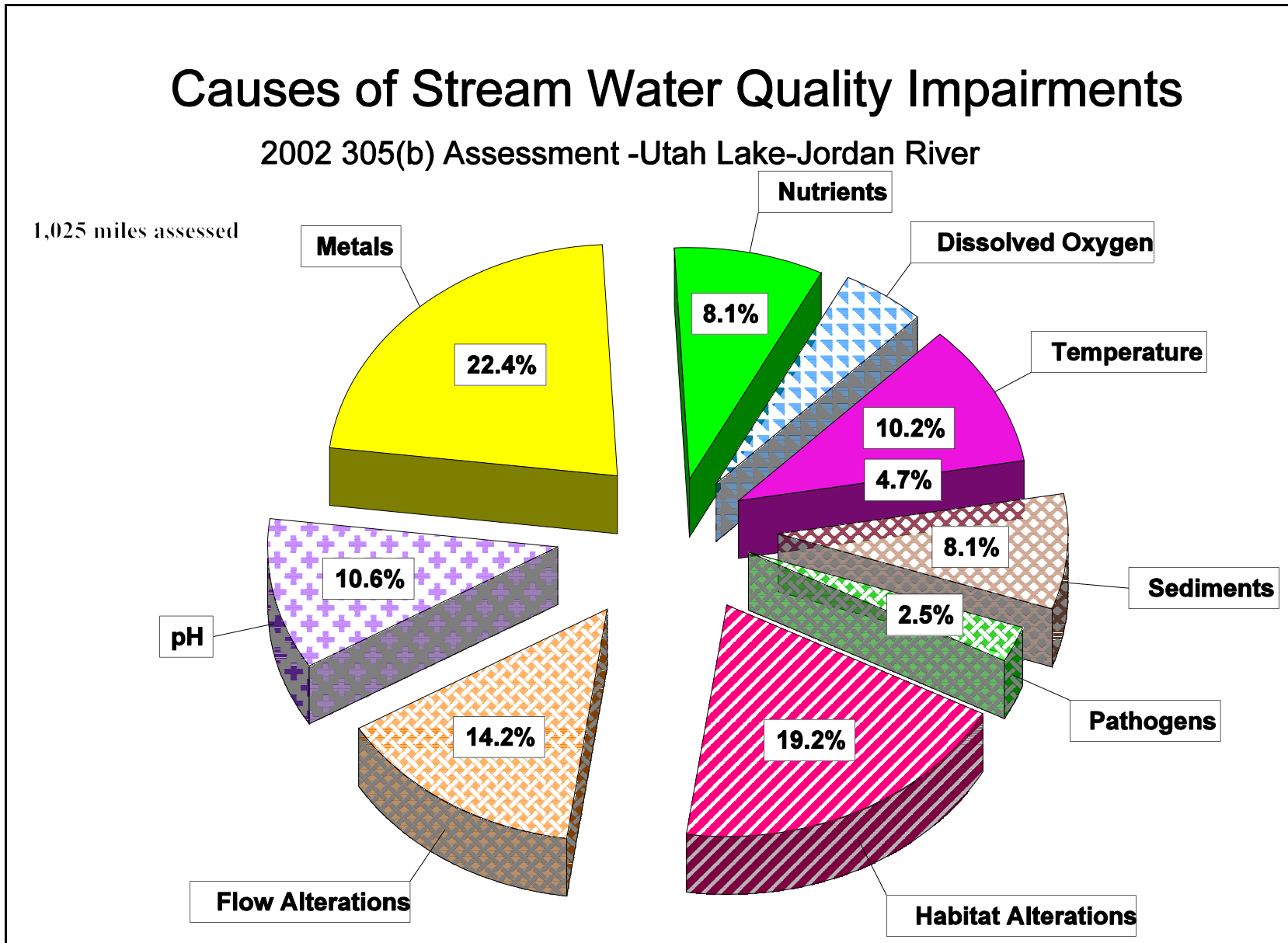

Figure IV-8. Relative percent contribution by cause to impairment of stream water quality -Utah Lake-Jordan River watershed.

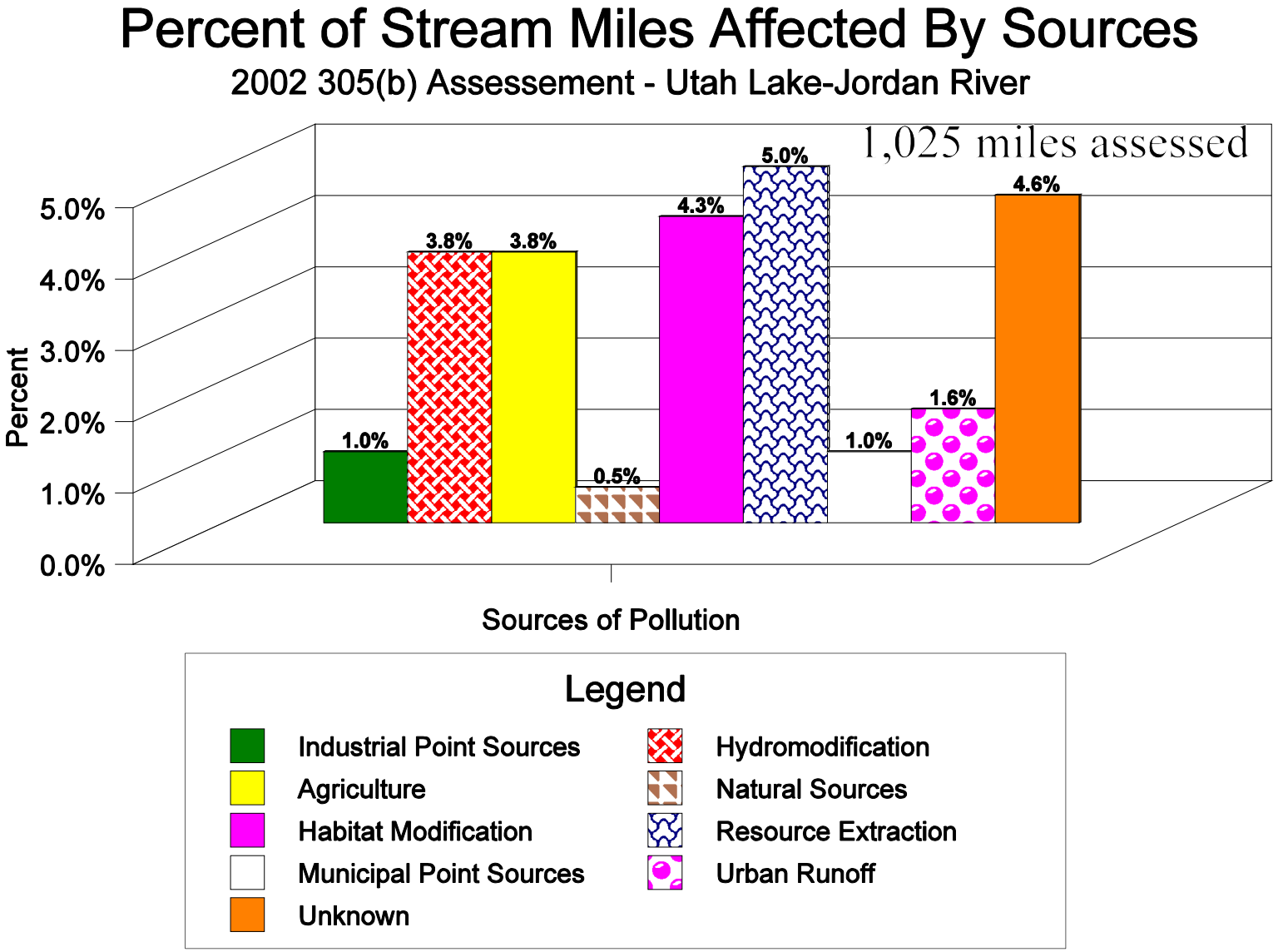

Figure IV-9. Percent of assessed stream miles impacted by sources - Utah Lake - Jordan River Watershed Management Unit.

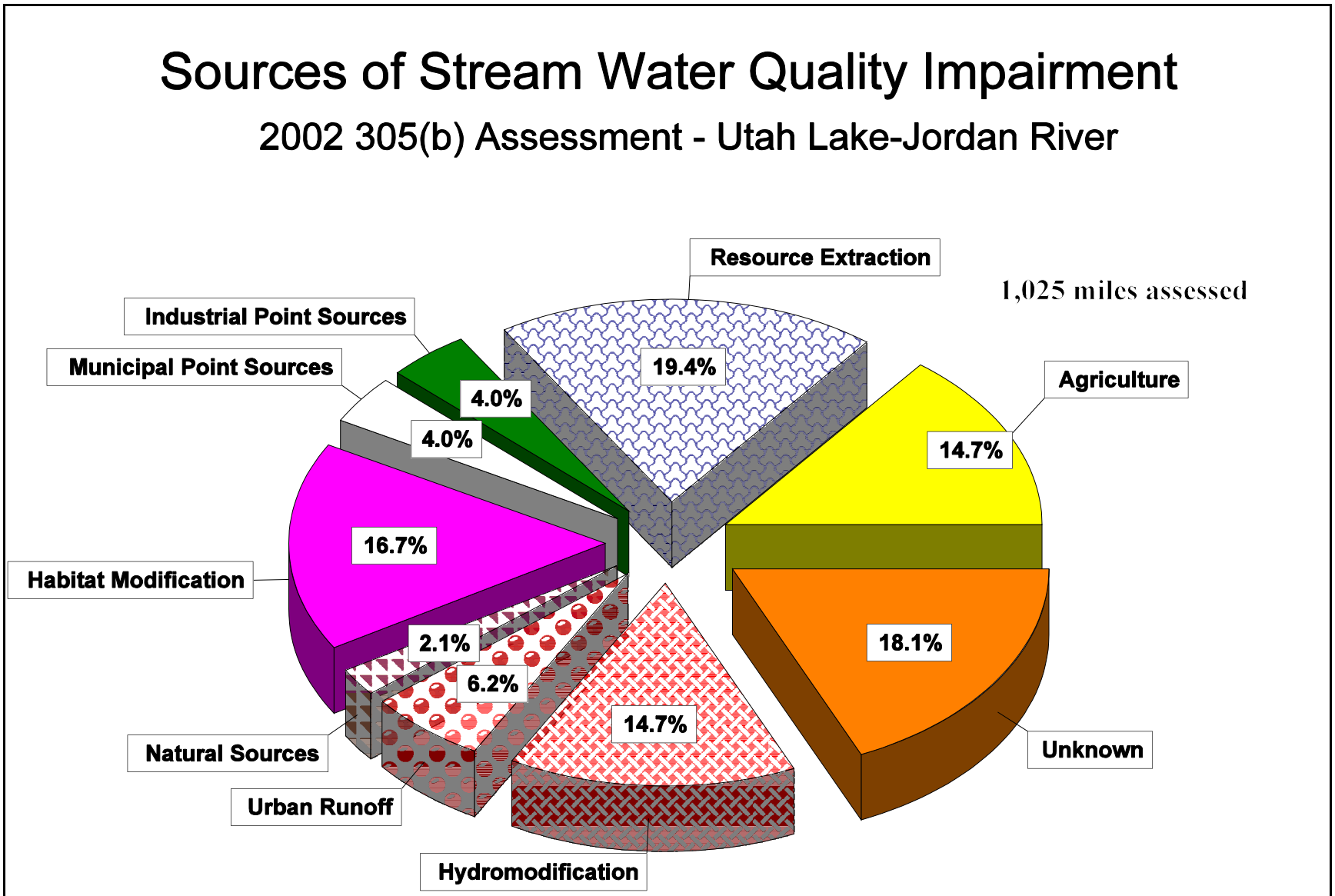

Figure IV-10. Relative percent contribution of sources to the impairment of stream water quality-Utah Lake-Jordan River watershed.

Chapter V: Lake Water Quality Assessment

Introduction

Lake eutrophication is a naturally occurring phenomenon or aging process that is often accelerated by human activities. Through a growing public awareness of this problem, Congress passed legislation in 1972 (Section 314 of the Federal Water Pollution Control Act) mandating states to inventory and classify their lakes according to trophic condition. States were initially to develop a ranking system used to prioritize the lakes for potential protective or restorative projects. This system was more recently replaced with the 1987 Clean Water Act Amendments requiring biannual 305(b) assessments and a concomitant 303(d) list of impaired waters.

Over three thousand bodies of water, i.e. lakes and reservoirs were identified in the initial Utah's Clean Lakes inventory. (State of Utah Clean Lakes Inventory and Classification, Volumes I & II, April 1982). Lakes selected for further study and evaluation ("significant lakes") were chosen according to the following criteria. The waterbody is any publicly owned lake/reservoir/pond with a surface area equal to or greater than 50 acres with the following characteristics: (1) accessibility to the public is provided; (2) beneficial use status has been defined or is anticipated to protect water quality for public benefit; and (3) the lake provides important recreational benefit to the public. Marshes, springs, waterfowl management areas and intermittent lakes were not considered in the report. Exceptions in size were made in cases of high recreation use. Under these guidelines, a list of 127 priority lakes and reservoirs was developed.

Table V-1 provides a summary of the number of lakes and lake surface area in the State of Utah. Seventy-seven percent of the total lake surface acres lake in Utah are found in 6 lakes and reservoirs, Bear Lake, Utah Lake, Flaming Gorge Reservoir, Lake Powell, Strawberry Reservoir, and Sevier Bridge Reservoir. The Great Salt Lake is not included in this table.

The State currently assesses 131 lakes and reservoirs. They include most of those previously inventoried. Changes were based on actual data collected and subsequent re-evaluation of the selection criteria for the original priority list. In addition, some new reservoirs that have been created since the original assessment in 1981-1982 and other lakes assessed by the State or other agencies on a cooperative basis have also been added. Water quality assessment includes determination of Carlson's trophic state index (TSI), dissolved oxygen concentrations throughout the water column, phytoplankton species dominance, reported fish kills and water quality trend. General ambient water quality conditions of Utah's lakes and reservoirs vary greatly in relation to their respective watersheds and lake morphometry. Nutrient concentrations and trophic status range from the oligotrophic conditions of many high mountain lakes to highly eutrophic downstream lakes such as Lower Box Reservoir, Redmond Reservoir, Utah Lake, Kent's Lake and Minersville Reservoir. Other water chemical characteristics vary from extremely soft water conditions of the high Uinta lakes to highly saline conditions in reservoirs on the lower Sevier drainage such as Gunnison Bend and D.M.A.D. Reservoirs.

Many lakes/reservoirs, both large and small, experience problems relating to thermal stratification and subsequent dissolved oxygen (DO) depletion in the hypolimnion. Several lakes experience fish kills each year due to DO depletion as a result of excessive algal production. Many lakes/reservoirs also have aesthetic and recreational use impairment because of severe annual drawdown leaving

Table V-1. Utah Freshwater Lakes and Reservoirs by Size Class Showing Numbers, Surface Acres, and Percent of Total Lake Surface		
Size Class (Surface Acres)	**Number of Lakes / Reservoirs**	**Total Surface Acres**
10,000 and greater	6 (0.2%)	370,905 (77.0%)
5,000 - 9,999	2 (0.07%)	15,584 (3.2%)
1,000 - 4,999	18 (0.6%)	34,119 (7.1%)
500 - 999	17 (0.57%)	12,475 (2.6%)
100 - 499	87 (2.9%)	19,890 (4.1%)
50 - 99	68 (2.3%)	4,594 (1.0%)
20 - 49	202 (6.7%)	5,871 (1.2%)
20 or less	2600 (86.7%)	18,200 (3.8%)
Total	3,000	481,638

expanses of exposed mud flats and often insufficient waters for overwintering fish populations. During recent years, an EPA assistance grant has been utilized to obtained additional water quality data to assist in the evaluation and assessment of lakes and reservoirs for this report. The initial purpose of this program was to assess newly created reservoirs and to conduct ongoing monitoring programs to reassess the lakes and reservoirs contained in the 1981-1982 Clean Lakes Inventory of the State of Utah. One half, or about 65 lakes are sampled each year, Hence, all 131 lakes are sampled over the two-year assessment period. Sampling is performed during two visits between June and September for the year it is scheduled. Occasionally, additional data may be obtained as part of cooperative programs with other agencies, during the winter period or to provide additional data for Total Maximum Daily Loads (TMDLs). During the summer of 2002, USU Extention Service assisted by the Division of Water Quality began a voluntary citizen monitoring program to provide additional water quality data and collect recreational usage data. Information pamphlets on subjects ranging from descriptions of nutrient loading and eutrophication to explaining our monitoring program have been distributed to popular recreational lakes and reservoirs in order to stimulate awareness of lake water quality and conditions in our State.

Trophic Status

Trophic status has been determined since the initial classification and inventory project in 1981-82 using Carlson's TSI. This has provided long-term trend data for most of Utah's lakes and reservoirs.

To determine the annual TSI values, the following procedure was used:

1 - Individual TSI values for total

phosphorus, secchi depth and chlorophyll-a was determined for each sampling station on the lake or reservoir.

2 - The values obtained from step one were then averaged among the two sampling visits at each of the sampling station.

3 - An average annual summer TSI value for each lake was then calculatedby averaging all the station TSI Index values for a given lake or reservoir.

4 - TSI Index values utilized in this report were calculated for each lake or reservoir by determining the average TSI value for the period in two year increment periods since 1989 (1989-1990, 1991-92, 1993-94, 1995-96, 1997-99, 2000-2001).

TSI values are compared to the following index values to determine current trophic state condition.

TSI Index value < 40 - Oligotrophic
TSI Index value 40 ↔ 50 - Mesotrophic
TSI Index value 50 ↔ 70 - Eutrophic
TSI Index value > 70 - Hypereutrophic

Table V-2 contains a summary of lake trophic status for Utah's lakes and reservoirs by study periods. Lakes that have been determined to be hypereutrophic during the various periods of study include the following waterbodies by periods: (1991-1992) Baker Dam Reservoir, DMAD Reservoir, Forsyth Reservoir, Gunnison Bend Reservoir, Johnson Reservoir, Koosharem Reservoir, Mill Meadow Reservoir, Redmond Reservoir, Rush Lake, Scofield Reservoir, Upper Enterprise Reservoir and Utah Lake; (1991-92) Barney Lake, Big Lake, Gunnison Bend Reservoir, Johnson Reservoir, Kents Lake, Lower Box Reservoir, Mill Meadow Reservoir, Mona Reservoir, Newton Reservoir, Redmond Reservoir, Rush Lake, Sevier Bridge Reservoir, Utah Lake and Willard Bay Reservoir; and (1993-94) Lower Bowns Reservoir, Rush Lake, Redmond Lake, Utah Lake, Kent's Lake, LaBaron Reservoir, Minersville Reservoir, Matt Warner Reservoir, Johnson Valley Reservoir, Newton Reservoir, Barney Reservoir and DMAD Reservoir; (1995-96) Rush Lake, Redmond Lake, Utah Lake, Kent's Lake, LaBaron Reservoir, Johnson Valley Reservoir, and Barney Reservoir; (1998-99) Koosharem Reservoir, Lower Box Reservoir, Redmond Reservoir, Rush Lake, and Utah Lake (2000-2001) Utah Lake, Redmond Lake, Panguitch Lake, Lower Box Reservoir, Koosharem Reservoir, Kents Lake and Cook Lake. In the last assessment period (2000-2001) there is an increase in the number of eutrophic lakes and a decrease in oligotrophic lakes. We believe that this change is largely due to the drought that began in 1998 and has continued to worsen.

Control and Restoration Efforts

Several of our watersheds are known to be impaired for water quality and these are reflected in our 2002 303(d) list of impaired waters. May of these problems were recognized several years ago and restoration efforts have been ongoing through Section 314 Clean Lakes Project grants, Section 319 grants and wastewater treatment plant upgrading. Best Management Practices (BMPs) which we are using to protect and restore water quality include chemical removal of phosphorus in wastewater treatment plants, eliminating the discharge of animal feeding operations to tributary streams, controlling grazing and restricting excessive animal stream access, establish riparian buffer strips adjacent to agricultural lands, restore stream bank and slope stability, maintaining property tidiness, keeping streets and gutters clean, reducing return flows

Table V-2. Trophic Status of Lakes.										
Trophic Class	Number and Acreage of Assessed Lakes and Reservoirs.									
	91/92		93/94		95/96		98/99		00/01	
Oligotrophic	27 (22%)	239888 (58%)	42 (32%)	290,432 (63%)	47 (36%)	285,154 (62%)	36 (28%)	288,029 (63%)	28 (21%)	50,380 (11%)
Mesotrophic	52 (42%)	21,061 (5%)	51 (39%)	46,678 (10%)	57 (44%)	59,191 (13%)	66 (52%)	63,648 (14%)	60 ((46%)	275,274 (60%)
Eutrophic	30 (24%)	31,990 (8%)	24 (19%)	22,670 (5%)	24 (19%)	116,166 (25%)	21 (16%)	11,390 (2%)	36 (27%)	36,285 (8%)
Hypereutrophic	15 (12%)	122,069 (29%)	13 (11%)	100,808 (22%)	1 (1%)	50 (-)	5 (4%)	97,500 (21%)	7 (5%)	98,703 (21%)
TOTALS	124	415,008	130	460,588	129	460,561	128	460,567	131	460,642

from excess irrigation, restricting excessive use of fertilizers and pesticides, and regulating off-road activities. Proper design, construction, and maintenance of sewage facilities, solid waste disposal facilities and fish cleaning stations have also been installed at popular lakes. Cooperation with other agencies, including the US Forest Service, BLM, NRCS and State conservation districts has facilitated the education of individuals using both public and private lands as to various activities which have the potential to adversely impact water quality and utilize practices to limit or control these negative impacts. Table V-3 contains a listing of specific lake rehabilitation techniques that have been used in addressing problems identified in diagnostic/feasibility studies funded under Section 314 of the Clean Water Act and ongoing lake assessments.

Specific watershed management plans or TMDLs (Total Maximum Daily Load) are currently being developed to address the unique problems and conditions identified for a particular lake or reservoir. In addition, wherever point sources are identified in a watershed that are impacting water quality, appropriate steps need to be taken to control the discharge of contaminants under existing water quality standards and guidelines. Clean Lakes Program Phase I studies were completed on Scofield Reservoir, Panguitch Lake, Deer Creek Reservoir, Bear Lake, Pineview Reservoir, Salem Pond, Minersville Reservoir, Otter Creek Reservoir, Navajo Lake, Mantua Reservoir, Pelican Lake, Hyrum Reservoir, East Canyon Reservoir and Utah Lake. Phase II lake restoration projects were conducted on four of these waterbodies (Panguitch Lake, Scofield Reservoir, Deer Creek Reservoir and Salem Pond). For specific details on Clean Lakes and Section 319 Projects, refer to the summary listed in Table V-4.

Impaired and Threatened Lakes

Several factors were considered in the assessment for beneficial use support. The monitoring program for lakes and reservoirs is designed to determine a basic water quality characterization, and evaluate the productivity during the summer period. Additional winter monitoring is conducted to evaluate dissolved oxygen deficiencies as indicated by the summer monitoring. Water quality standards are evaluated to assess impairment for waters classified in classes 2 (recreation), 3 (aquatic life), and 4 (agriculture). Three basic areas of data that are compared to standards in addition to other specific parameters include dissolved

oxygen, pH, and temperature. These basic parameters are obtained in the field as part of the overall monitoring program for Utah's lakes and reservoirs. The data for these three parameters are analyzed for the entire water column and evaluated according to current 305(b) guidelines. A comparison of water standards is determined as follows. For any one pollutant or stressor, exceedence of standards in less than or equal to 10 percent of

Table V-3. Lake Rehabilitation Techniques.

Technique	Lakes using Technique	Lake Acreage
In-lake Treatments		
1. Phosphorus Precipitation/Inactivation		
2. Sediment Removal/Dredging	1	11
3. Artificial circulation to increase oxygen		
4. Aquatic Macrophyte harvesting	1	120
5. Application of aquatic herbicides		
6. Drawdown for macrophyte control		
7. Hypolimnetic aeration		
8. Sediment oxidation		
9. Hypolimnetic withdrawal of low DO water		
10. Dilution/Flushing		
11. Shading/sediment covers or barriers		
12. Destratification		
13. Sand or other filters to clarify water		
14. Food chain manipulation		
15. Biological controls	1	11
16. Fish Clean Station Installed	23	437,046
Watershed Treatments		
20. Sediment Traps/Detention ponds	2	1,368
21. Erosion control Shoreline/Streambank	7	26,565
22. Diversion of nutrient rich inflows		
23. Conservation tillage used		
24. Integrated pest management practices applied		
25. Animal waste management practices installed	6	9,850
26. Porous pavement used		
27. Redesign streets/parking lots to reduce runoff		
28. Road or skid trail management		
29. Land surface roughening for erosion control		
30. Riprap installation	2	4,063
31. Unspecified BMPs installed	8	2,965
32. Riparian Fencing	8	12,924
33. Diversion structures installed	1	2,015
34. Checkdams or stream structures	6	9,850
35. Reseeding areas for erosion control	6	9,850
36. Streambank stabilization using vegetative controls	6	12,924
37. Wetland treatment of inflow waters	1	11

Table V-3. Lake Rehabilitation Techniques.		
Technique	**Lakes using**	**Lake**
Other Lake Protection/Restoration Efforts	**Technique**	**Acreage**
40. Local Lake Management Program in place	3	168,540
41. Public Information/Education Program	16	133,288
42. Local Ordinance control to protect lakes	3	4,063
43. Point Source Controls	2	4,359
44. Municipal sewer system developed	1	2,815

Table V-4. Listing of Phase II and Section 319 Projects for Lake Water Quality Control.

Name of Lake	Date Completed	Type	Federal Funding	Problems	Rehabilitation Techniques
Minersville	1991-1998	319	$ 889,120	Eutrophication	21,25,31,32,35,36,41
Hyrum Reservoir	1991-1995	319	$1,582,215	Eutrophication	10,16,21,25,31,32,35,36,41
Otter Creek	1991-1998	319	$682,000	Eutrophication	16,21,25,31,32,35,36,41
Echo	1992-1998	319	$2,050,6000	Eutrophication	16,21,25,31,32,35,41
Scofield	1992	Phase II	$120,000	Watershed Erosion	16,21,30,32,33,34,35,36,41,
Panguitch Lake	1989	Phase II	$ 95,925	Watershed Erosion	16,20,21,30,32,34,35,36,41,
Deer Creek	1992	Phase II	$328,393	Agricultural Wastes	20,21,25,29,31,40,41,42,43
Salem Pond	1995	Phase II	$ 95,000	Macrophytes, Depth	2,15,37,41,
Decker Lake		Phase II	$1,000,000	Sedimentation	2

measurements, results in a designation of **fully supporting** was assigned. For any one pollutant or stressor, criteria exceeded in greater than 10, but less than or equal to 25 percent of measurements, a designation of **partially supporting** was assigned. For any one pollutant or stressor, criteria exceeded in greater than 25 percent of measurements a designation of **not supporting** was assigned. An exception to these guidelines has been provided for dissolved oxygen. Exceedance criteria for dissolved oxygen have been defined using the 1 day minimum dissolved oxygen concentration of 4.0 mg/l State standards account for the fact that anoxic or low dissolved oxygen conditions may exist in the bottom of deep reservoirs and therefore, the dissolved oxygen standard is applied as follows. When the concentration is above 4.0 mg/l for greater than 50% of the water column depth, a fully supporting status is assigned. When 25-50% of the water column is above 4.0 mg/l, it is designated as partial supporting and when less than 25% of the water column exceeds the 4.0 mg/l criteria, it is designated as not supporting its defined beneficial use.

Having determined support status for individual pollutants or stressors, an overall use designation was determined based on a combination of the individual pollutant or stressor support designations. A **`not supporting´** status was assigned to a body of water when at least two of the basic criteria (dissolved oxygen, pH or temperature) were found to be not supportive. A **`fully supporting´** status was assigned when all of the criteria were found to be fully supporting. All

other waterbodies were assigned a **'partially supporting'** status for criteria found in the various remaining combinations.

Next there is a modification of the initial support status through an evaluation of the trophic state index (TSI), winter dissolved oxygen conditions with reported fish kills, and the presence of significant blue green algal species in the phytoplankton community. This evaluation, although based to an extent on professional judgement, could shift initial support status ranking downward if two of the three criteria indicate there is an impairment in the water quality.

A final determination to list the waterbody is made through an evaluation of assessment trends since 1989. Since that time, we have incorporated the hydrology and seasonal variations associated with lakes and reservoirs. In general if a waterbody exhibits a consistent status of **'partial supporting or not supporting'**, it should be entered on the 303(d) list. Lakes that exhibit a mixture of partially and fully supporting conditions over a period of time are not listed. For such borderline lakes, two consecutive assessment cycles demonstrating impairment, as well as a long-term downward trend in TSI, winter dissolved oxygen, or increased densities of blue green algae are required before we list the waterbody as impaired.

Where other data was obtained (dissolved metal data or biological data) determinations of exceedence against reported water quality standards were made, but in only one case (Lake Powell) have portions of the waterbody, on occasion, been identified as partially supporting from heavy metal contamination.

Table V-5 presents summary data or each of the 131 lakes and reservoirs. Table V-6 lists the total in each support status. Of the 460,642 surface acres evaluated 69% were found to be supporting their designated uses, 30.5% partially supporting and 0.5% not supporting.

Tabulation by individual lakes indicates that for the 131 lakes assessed 54% were fully supporting, 37% partially supporting and 8% not supporting. It should be noted that the biological data used to modify the initial conventional assessment (winter dissolved oxygen and fish kills) may have been collected prior to the data summary period (1999-2000) for this report. Table V-7 summarizes the use support by classification. Tables V-8 and V-9 summarize the various cause and source categories for those lakes found not fully supporting their designated uses. The Division of Water Quality will continue to conduct reconnaissance level investigations on several lakes and reservoirs in the future with other agencies including but not limited to the following: Strawberry Reservoir, Lake Powell, and Flaming Gorge Reservoir. However, all of these studies will depend on the available manpower and resources and will be limited by the amount of available State resources.

Acid Effects on Lakes

Since this report came out, the Acid Deposition Technical Advisory Committee has been relatively inactive. In 1986, the Acid Deposition Technical Advisory Committee recommended that reconnaissance surveys be conducted in areas considered potentially sensitive to acid deposition. In response to this recommendation, a cooperative agreement involving private individuals, private industries, and several State and Federal agencies was developed and approved. This agreement organized efforts to sample selected streams and lakes in ten different mountain ranges in Utah during the summer of 1987. The water chemistry data were then used to determine the Acid Neutralizing Capacity (ANC) of the sampled lakes and streams and their sensitivity to acid deposition. Generally, it was concluded

that several of the high lakes in the State, were susceptible to acid precipitation due to their low buffering capacities but at the moment, none were actually affected by acid deposition.

Table V-5. Summary of Individual Lake Beneficial Use Support.

LAKE DESCRIPTION	ACRES	OVERALL SUPPORT STATUS					OVERALL SUPPORT (Acreage)			On 303d list	Conventional Parameters DO, Temp, pH	Total P > 0.025 mg/L Indicator	TSI >50	Winter DO/ Fish Kills	BG Algae
		1994	1996	1998	2000	2002	FS	PS	NS						
Anderson Meadow Reservoir	8	PS	FS	FS	FS	FS	8				FS				Y
Ashley Twin Lakes	27	FS	FS	ND	FS	PS		27			FS				N
Baker Dam Reservoir	63			NS	PS	PS		63		X	PS- T,DO	Y	Y		Y
Barney Reservoir	19	PS	PS	PS	FS	PS		19			PS- DO	Y	Y		Y
Bear Lake	69,760	FS	FS	FS	FS	FS	69,760				FS				N
Beaver Meadow Reservoir	5	FS	FS	FS	FS	FS	5				FS				N
Big East Lake	23	NS	NS	PS	PS	PS		23		X	PS- DO		Y		Y
Big Sand Wash Reservoir	390	FS	FS	PS	FS	FS	390				FS				Y
Birch Creek Reservoir #2	63	PS	PS	PS	FS	FS	63				FS				N
Blanding City Reservoir #4	32	PS	NS	PS	FS	FS	32				FS				N
Bridger Lake	21	PS	PS	PS	PS	PS		21		X	PS- DO			DO	Y
Brough Reservoir	150		NS	NS	PS	PS		150		X	PS- T,DO				Y
Browne Reservoir	54	PS	PS	PS	PS	PS		54		X	PS- DO	Y	Y	DO	Y
Butterfly Lake	5	PS	PS	FS	FS	FS	5				FS				Y
Calder Reservoir	99		PS	NS	PS	PS		99		X	PS- DO	Y	Y	DO/FK	Y
Causey Reservoir	142	PS	PS	PS	FS	FS	142				FS				N
China Lake	47	PS	NS	NS	NS	NS			47	X	NS- T,DO			DO/FK	Y
Cleveland Reservoir	185	PS	PS	PS	FS	FS	185				FS				Y
Cook Lake	9	PS	PS	PS	FS	PS		9			PS-pH	Y	Y		ND
Currant Creek Reservoir	305	PS	FS	FS	FS	FS	305				FS				Y
Dark Canyon Lake	6		PS	PS	FS	FS	6				FS				ND
Deer Creek Reservoir	2,965	PS	PS	PS	PS	PS		2,965		X	PS- DO,T	Y			Y
DMAD Reservoir	1,199	PS	PS	FS	FS	FS	1,199				FS		Y		Y
Donkey Reservoir	40	PS	PS	FS	FS	FS	40				FS				N
Duck Fork Reservoir	47	FS	PS	PS	FS	FS	47				FS	Y	Y	DO	N
East Canyon Reservoir	173	NS	NS	NS	NS	NS			173	TMDL Completed	NS- DO	Y	Y	FK	Y
East Park Reservoir	684	FS	FS	FS	PS	FS	684				FS			DO	Y
Echo Reservoir	1,394	PS	PS	PS	PS	PS		1,394		X	PS- DO/T	Y	Y		Y
Electric Lake	425	PS	PS	PS	FS	FS	425				FS				Y
Fairview Reservoir #2	105	PS	PS	PS	FS	FS	105				FS				N
Ferron Reservoir	55	PS	PS	PS	FS	FS	55				FS				N
Fish Lake	2,500	PS	PS	PS	FS	FS	2,500				FS				N
Flaming Gorge Reservoir	42,020	FS	FS	FS	FS	FS	42,020				FS				Y
Forsyth Reservoir	158	PS	PS	PS	PS	PS		158		X	PS- DO		Y		N
Grantsville Reservoir	88		FS	FS	FS	FS	88				FS				Y
Gunlock Reservoir	266	PS	PS	PS	PS	PS		266		X	PS- DO	Y			Y
Gunnison Bend Reservoir	706	FS	FS	FS	FS	FS	706				FS		Y		N
Gunnison Reservoir	1,287	PS	PS	PS	FS	FS	1,287				FS	Y			N
Hoop Lake	162	PS	PS	FS	FS	FS	162				FS				Y
Hoover Lake	17	PS	FS	FS	FS	FS	17				FS				Y
Huntington Lake North	225	PS	FS	PS	FS	FS	225				FS				N
Huntington Reservoir	115	PS	PS	PS	FS	FS	115				FS				N
Hyrum Reservoir	438	PS	PS	NS	PS	PS		438		X	PS- T,DO				N
Joes Valley Reservoir	1,183	PS	PS	FS	FS	FS	1,183				FS				N
Johnson Valley Reservoir	285		PS	PS	PS	PS		285		X	PS- DO	Y	Y	DO	Y
Jordanelle Reservoir	3,068	NS	PS	FS	FS	FS	3,068				FS				N

Table V-5. Summary of Individual Lake Beneficial Use Support.															
LAKE DESCRIPTION	ACRES	OVERALL SUPPORT STATUS					OVERALL SUPPORT (Acreage)			On 303d list	Conventional Parameters DO, Temp, pH	Total P > 0.025 mg/L Indicator	TSI >50	Winter DO/ Fish Kills	BG Algae
		1994	1996	1998	2000	2002	FS	PS	NS						
Kens Lake	86	PS	PS	NS	PS	PS		86		X	PS, T				N
Kents Lake	26		NS	NS	PS	PS		26		TMDL Completed	PS- T,DO	Y	Y		N
Kolob Reservoir	335	PS	PS	PS	FS	PS		335			PS- DO	Y			
Koosharem Reservoir	310	PS	PS	PS	PS	PS		310		X	FS	Y	Y		Y
Labaron Reservoir	24	PS	NS	NS	NS	NS			24	TMDL Completed	PS- DO			DO	Y
Lake Mary	23	PS	PS	PS	FS	FS	23				FS				N
Lake Powell	162,760	FS	FS	FS	FS	FS	200,000				FS				ND
Little Creek Reservoir	65	FS	PS	PS	FS	FS	65				FS				Y
Little Dell Reservoir	249	FS	PS	PS	FS	FS	249				FS				Y
Lloyds Reservoir	104	PS	PS	PS	FS	FS	104				FS				Y
Long Park Reservoir	60	PS	FS	FS	FS	FS	60				FS				Y
Lost Creek Reservoir	52	PS	PS	FS	FS	FS	52				FS				N
Lower Bowns Reservoir	90	PS	PS	PS	FS	FS	90				PS-pH	Y			Y
Lower Box Reservoir	50	PS	NS	NS	PS	PS		50		X	PS- DO	Y	Y		Y
Lower Gooseberry Reservoir	57	PS	NS	PS	PS	PS		57		X	PS- pH	Y		DO	Y
Lyman Lake	27	PS	NS	NS	PS	PS		27		X	PS- DO			DO	Y
Manning Meadow Reservoir	59	PS	NS	NS	PS	PS		59		X	PS- DO	Y	Y	DO/FK	N
Mantua Reservoir	554	NS	NS	NS	PS	PS		554		X	PS- T,pH	Y			Y
Marsh Lake	38	NS	NS	NS	PS	PS		38		X	PS- DO			DO/FK	Y
Marshall Reservoir	18	PS	PS	PS	FS	PS		18			PS- DO			DO/FK	Y
Matt Warner Reservoir	433		NS	NS	NS	NS			433	X	PS- DO,T	Y	Y	DO/FK	N
Meeks Cabin Reservoir	477	PS	FS	FS	FS	FS	477				FS				N
Mill Hollow Reservoir	15	PS	PS	PS	PS	PS		15		X	PS- pH	Y	Y		Y
Mill Meadow Reservoir	156		PS	PS	PS	PS		156		X	PS- DO	Y	Y		Y
Miller Flat Reservoir	65	PS	FS	FS	FS	FS	65				FS				Y
Millsite Reservoir	435	PS	FS	PS	FS	FS	435				FS				N
Minersville Reservoir	990	PS	PS	NS	PS	PS		990		TMDL Completed	PS- T		Y		N
Mirror Lake	50	PS	PS	PS	PS	PS		50		X	PS-DO	Y		DO	Y
Mona Reservoir	1,110	PS	FS	FS	FS	FS	1,110				FS				N
Monticello Lake	3	PS	FS	FS	FS	FS	3				FS				N
Moon Lake	768	PS	FS	FS	FS	FS	768				FS				N
Navajo Lake	714	NS	NS	PS	PS	PS		714		X	PS-DO,pH			DO/FK	NA
Newcastle Reservoir	163	PS	NS	NS	NS	NS			163	X	PS-DO,T		Y		N
Newton Reservoir	350	PS	NS	NS	NS	NS			350	X	PS- DO	Y	Y		Y
Nine Mile Reservoir	197	PS	NS	NS	NS	NS			197	X	NS- T, pH PS-DO	Y	Y		N
Oak Park Reservoir	382	PS	PS	FS	FS	FS	382				FS				N
Otter Creek Reservoir	2,520	PS	PS	PS	NS	PS		2,520		X	PS- T	Y	Y		Y
Palisades Lake	66	PS	PS	PS	PS	PS		66		X	PS- T	Y			N
Panguitch Lake	1,248	PS	PS	NS	PS	PS		1,248		X	PS- DO	Y	Y		Y
Paradise Park Reservoir	143	PS	FS	FS	FS	FS	143				FS				N
Pelican Lake	1,680	NS	NS	PS	FS	PS		1,680			PS- pH	Y			Y
Pine Lake	77	PS	NS	PS	FS	PS		77			PS- pH				N
Pineview Reservoir	2,874	PS	NS	PS	PS	PS		2,874		X	PS-T, DO	Y			Y
Piute Reservoir	2,508	PS	FS	PS	PS	PS		2,508		X	PS- T	Y	Y		Y
Porcupine Reservoir	190	PS	PS	PS	PS	PS		190		X	PS- T	Y			N
Posey Lake	20	NS	PS	PS	FS	FS	20				FS	Y			N
Puffer Lake	65	NS	PS	NS	PS	PS		65		TMDL Completed	PS-DO			FK	Y
Quail Creek Reservoir	590	PS	PS	PS	FS	FS	590				FS				N

Table V-5. Summary of Individual Lake Beneficial Use Support.															
LAKE DESCRIPTION	ACRES	OVERALL SUPPORT STATUS					OVERALL SUPPORT (Acreage)			On 303d list	Conventional Parameters DO, Temp, pH	Total P > 0.025 mg/L Indicator	TSI >50	Winter DO/ Fish Kills	BG Algae
		1994	1996	1998	2000	2002	FS	PS	NS						
Recapture Reservoir	265	NS	NS	PS	PS	PS		265		X	PS- DO,T				N
Red Creek Reservoir	142	PS	PS	PS	FS	FS	142				FS				Y
Red Creek Reservoir (Iron Co.)	39	PS	NS	NS	NS	NS			39	X	PS- DO	Y	Y	DO	N
Red Fleet Reservoir	520	PS	PS	FS	PS	PS		520		X	PS- T,DO				Y
Redmond Lake	160	PS	FS	PS	FS	FS	160				FS		Y		N
Rex's Reservoir	46	PS	PS	PS	FS	FS	46				FS				N
Rockport Reservoir	1,189	PS	PS	FS	FS	FS	1,189				FS				Y
Rush Lake	80	PS	NS	PS	FS	FS	80				FS	Y	Y		N
Salem Pond	11	PS	PS	FS	FS	FS	11				FS				N
Scofield Reservoir	2,815	PS	PS	PS	PS	PS		2,815		TMDL Completed	PS-DO	Y		DO/FK	Y
Scout Lake	18	PS	FS	FS	FS	FS	18				FS				N
Settlement Canyon Res	315	PS	PS	FS	FS	FS	315				FS				N
Sevier Bridge Reservoir	10,905	PS	PS	FS	FS	FS	10,905				FS				Y
Sheep Creek Reservoir	86	PS	PS	PS	FS	FS	86				FS				Y
Silver Lake Flat Reservoir	54				FS	FS	54				FS				N
Smith and Morehouse Reservoir	197	PS	FS	PS	FS	FS	197				FS				N
Spirit Lake	41	PS	FS	PS	PS	PS	41								N
Stansbury Lake	120	FS	FS	PS	FS	FS	120				FS				N
Starvation Reservoir	2,760	PS	FS	PS	FS	PS		2,760			PS- DO	Y	Y		Y
Stateline Reservoir	288	PS	FS	FS	FS	FS	288				FS				N
Steinaker Reservoir	829	PS	PS	PS	PS	PS		829		X	PS-T, DO				Y
Strawberry Reservoir	17,160	PS	PS	PS	PS	PS		17,160		X	PS- DO	Y		DO	Y
Three Creeks Reservoir	57	PS	PS	PS	FS	FS	57				FS				Y
Tibble Fork Reservoir	13	FS	FS	FS	FS	FS	13				FS				N
Tony Grove Reservoir	25	NS	NS	NS	NS	NS			25	X	NS- DO	Y		FK	Y
Trial Lake	98	PS	PS	FS	FS	FS	98				FS				N
Tropic Reservoir	180	PS	PS	PS	FS	FS	180				FS				N
Upper Enterprise Reservoir	200	NS	NS	NS	FS	NS			200		NS DO, T	Y			Y
Upper Stillwater Reservoir	252	PS	FS	FS	FS	FS	252				FS				Y
Utah Lake	96,900	PS	PS	PS	PS	PS		96,900		X	FS	Y	Y		Y
Wall Lake	61	FS	PS	FS	FS	FS	61				FS				N
Washington Lake	94	PS	FS	FS	FS	FS	94				FS				N
Whitney Reservoir	188	PS	FS	PS	FS	FS	188				FS				Y
Wide Hollow Reservoir	145	PS	NS	NS	FS	NS			145		NS- T, pH	Y			N
Willard Bay Reservoir	10,000	FS	PS	PS	FS	FS	10,000				FS	Y			Y
Woodruff Creek Reservoir	90	PS	PS	PS	FS	FS	90				FS				Y
Yankee Meadow Reservoir	5	PS	PS	NS	PS	PS		5		X	PS- DO		Y	FK	N

Table V-6. Overall Use Support Summary for Lakes and Reservoirs (Acres).

Degree of Use Support	Assessed		Monitored		Total Assessed	
	Number	Acreage	Number	Acreage	Number	Acres
Fully supported:	2	204,780	69	112087	71	316,867
Threatened:	0	0	0	0	0	0
Partially supporting:	0	0	49	141,979	49	141,979
Not supporting:	0	0	11	1,796	11	1,796
Total Size Assessed:	2	204,780	129	297,867	131	460,642

Table V-7. Individual Use Support Summary (Acres).

Use	Supporting	Supporting but Threatened	Partially Supporting	Not Supporting	Not Attainable	Unassessed
Fish Consumption		0	0	0	0	460,642
Aquatic Life Support	316,867	0	135,218	3,971	0	0
Shellfishing	0	0	0	0	0	460,642
Swimming	162,760			0	0	297,882
Secondary Contact	162,760			0	0	297,882
Drinking Water Supply	252,643	0	0	0	0	228,994
Agriculture	363,742	0	96,900	0	0	20,920

Table V-8. Total Size of Lake Waterbodies Not Fully Supporting Uses Affected By Various Cause Categories (Acres).

Cause Categories Threatened	Major Impact	Moderate Impact	Minor Impact
Cause Unknown			
Unknown Toxicity			
Pesticides			
Priority Organics	---	---	---
Nonpriority Organics	---	---	---
Metals	0	0	0
Ammonia	0	0	0
Chlorine	---	---	---

Table V-8. Total Size of Lake Waterbodies Not Fully Supporting Uses Affected By Various Cause Categories (Acres).			
Cause Categories Threatened	**Major Impact**	**Moderate Impact**	**Minor Impact**
Other Inorganics	0	0	0
Nutrients	133,247	3,928	0
pH	0	2980	0
Siltation	106,356	22,053	0
Organic Enrichment / DO	100,665	133,247	0
Salinity / TDS / Chlorine	96,900	0	0
Thermal Modification	0	0	0
Flow Alteration	---	---	—
Habitat Alteration	*	*	
Pathogen Indicators	0	1,000	0
Radiation	---	---	—
Oil and Grease	0	97,073	0
Suspended Solids	97,185	0	0
Noxious Aquatic Plants	5,849	754	—
Total Toxics	---	---	—
Turbidity	---	---	—
Exotic Species	---	---	—
Filling and Draining	11,465	5,915	---

Table V-9. Total Size of Lake Waterbodies Not Fully Supporting Uses Affected By Various Source Categories (acres).			
Source Categories Threatened	**Major Impact**	**Moderate impact**	**Minor Impact**
Industrial Point Sources	97,892	0	0
Municipal Point Sources	99,021	2,965	0
Agriculture	16,796	120,613	0
Silviculture	0	990	0
Construction	4,295	103,225	0
Runoff / Storm Sewers	101,437	0	0
Resource Extraction	0	173	0
Land Disposal	0	0	0
Hydromodification	110,828	21,472	0
Habitat Modification			
Marinas	0	0	0

Table V-9. Total Size of Lake Waterbodies Not Fully Supporting Uses Affected By Various Source Categories (acres).			
Source Categories Threatened	**Major Impact**	**Moderate impact**	**Minor Impact**
Atmospheric Deposition	0	0	0
Contaminated Sediments	0	0	0
Unknown Source	---	---	---
Natural Source	---	---	---

Toxic Effects on Lakes

All 131 lakes/reservoirs were assessed for toxic metals during this reporting cycle (Table V-10). Because of the association of metal solubility with decreasing reduction/oxidation potential at the sediment-water interface, samples were collected approximately 0.5 m above the bottom of the lake or reservoir to detect the maximum concentration within the lake. Resulting data were compared to numeric standards for the protection of aquatic life. This monitoring would also evaluate the potential for uptake of toxic metals into the food chain initiated by benthic organisms. Hence, this type of sampling is used a s screening tool and additional water column sampling would be performed to identify the frequency of exceedence and subsequent impairment. Although some tributary stream segments have been identified as impaired with various toxic metals, no lake samples have contained metal concentrations above the chronic water quality standards.

Table V-10. Summary of Total Lake Waterbody Size Affected by Toxics.		
Waterbody Type / Unit	**Size Monitored For Toxics**	**Size With Elevated Levels of Toxics**
Lake (Acres)	460,642	0

Trends in Lake Water Quality

Table V-11 summarizes the trends in water quality of those lakes assessed under the Lake Water Quality Assessment program. The 1981 data represents eighty-nine lakes and reservoirs where comparable data existed from the original inventory and classification study completed in 1982. These data represent a comparison of lakes and reservoirs present during the last six periods of the study (1989-90, 1991-92, 1993-94, 1995-96, and 1997-99, 2000-2001).Carlson TSI values for each waterbody were determined and then compared to values obtained during previous periods of study for comparative lakes or reservoirs (Table V-12). Unknown values were due to data not available at the time of assessment or the reservoir was dry. The initial data period contains the information collected for the Clean Lakes Inventory for Utah in 1982. It should be noted that the1982 data set in many cases is limited to total phosphorus and Secchi depth data or only one of the two. Chlorophyll *a* data is very limited during that study period. Trends for water quality were then determined from these comparisons. A TSI value

comparison yielding a variation of ≤ 5 indicated a stable trend. A TSI value comparison yielding and increase of more than 5 reported as a degrading condition. A TSI value comparison yielding a decrease of more than 5 is reported as an improving condition.

Table V-11. Trends in Water Quality of Lakes and Reservoirs.

Trend Category	Number of Lakes						Number of Acres					
	1989 1990	1991 1992	1993 1994	1995 1996	1997-1999	2000-2001	1989 1990	1991 1992	1993 1994	1995 1996	1997-1999	2000-2001
Improve	27 30%	24 24%	40 31%	32 25%	16 12%	8 6%	9,087 5%	177,785 45%	55,302 13%	10,254 2%	4,525 1%	42,583 9%
Stable	44 50%	49 52%	70 54%	88 68%	72 55%	78 60%	149,360 91%	204,223 51%	356,097 85%	449,631 98%	436,533 95%	346,863 75%
Degrade	18 20%	23 24%	15 12%	8 6%	39 30%	5 4%	6,609 4%	15,251 4%	6,759 2%	670 ---	19,455 4%	71,208 15%
Unknown			5 4%	1 1%	4 3%	12 9%			4,2430 1%	6 ---	129 ---	849 2%
Assessed for Trends	89	95	130	128	131		165,056	397,259	460,588	460,561	460,642	460,642

Table V-12. Utah Reservoir / Lake Monitoring List and TSI Evaluation.

Lake / Reservoir	TSI Index 1989-90	1991-92	1993-94	1995-96	1997-99	1999-2001	Surface Area (Acres)
Anderson Meadow Reservoir	52.69	50.18	43.87	46.99	44.28	35.50	8
Ashley Twin Lakes			41.52		39.16	35.01	27
Baker Dam Reservoir	62.33	50.42	46.25	50.90	50.67	41.71	63
Barney Lake		61.46	60.70	62.56	50.23	50.17	19
Bear Lake	37.57	32.36	32.73	29.62	34.45	45.05	69760
Beaver Meadow Reservoir			45.98	44.28	49.44	47.44	5
Big East Lake	52.42	48.32	41.48	40.58	42.11	47.72	23
Big Sand Wash Reservoir	46.11	45.28	38.97	39.02	41.48	48.43	390
Birch Creek Reservoir #2	52.35	47.4	49.07	36.59	45.12	44.32	63
Blanding Reservoir #4	48.4		46.74	35.83	39.80	29.85	32
Bridger Lake		46.72	51.82	46.94	46.12	44.82	21
Brough Reservoir			44.74	41.64	41.23	NA	150
Browne Lake	40.27	45.31	47.02	50.2	50.95	NA	54
Butterfly Lake	40.71	35.99	77.79	37.14	44.19	33.50	5
Calder Reservoir		54.14	59.49	59.54	58.85	57.78	99
Causey Reservoir	43.23	38.79	43.41	38.15	33.64	NA	142
China Lake		45.59	34.87	45.09	48.51	43.83	47
Cleveland Reservoir	41.66	51.61	42.75	35.57	46.87	46.87	185

Table V-12. Utah Reservoir / Lake Monitoring List and TSI Evaluation.							
Lake / Reservoir	TSI Index 1989-90	1991-92	1993-94	1995-96	1997-99	1999-2001	Surface Area (Acres)
Cook Lake	44.01	48.18	44.42	46.38	ND	49.36	9
Currant Creek Reservoir	44.15	42.03	38.26	40.72	44.03	45.18	305
Dark Canyon Lake			40.2		ND	NA	6
Deer Creek Reservoir	47.79	47.04	43.14	42.58	43.64	42.24	2965
DMAD Reservoir	65.29	57.34	60.55	56.99	56.34	52.55	1,199
Donkey Reservoir	48.64	44.57	44.16	41.82	42.29	40.19	40
Duck Fork Reservoir		39.75	28.05	37.51	42.89	39.96	47
East Canyon Reservoir	48.7	52.82	49.59	48.42	43.72	46.48	173
East Park Reservoir		48.35	41.41	45.98	47.18	44.48	684
Echo Reservoir		39.07	41.8	45.16	39.19	50.67	1,394
Electric Lake Reservoir	39.43	49.74	43.92	40.23	44.13	48.19	425
Fairview Reservoir	52.72	38.92	39.25	33.76	38.43	33.44	105
Ferron Reservoir	43.37	39.86	35.47	31.82	39.92	40.41	55
Fish Lake	41.26	40.26	33.59	34.39	34.49	35.77	2,500
Flaming Gorge Reservoir	42.75		36.47	37.32	39.61	31.93	42,020
Forsyth Reservoir	61.88	52.76	56.87	49	55.33	50.75	158
Grantsville Reservoir	43.63	49.09	46.47	41.11	49.56	45.28	88
Gunlock Reservoir	42.47	42.31	47.41	42.61	40.15	38.81	266
Gunnison Bend Reservoir	63.04	62.38	55.04	54.03	58.08	53.56	706
Gunnison Reservoir	61.41	63.96	56.81	55.24	47.71	54.27	1,287
Hoop Lake	57.44	49.8	59.27	49.34	47.48	NA	162
Hoover Lake	40.22	38.72	36.26	35.72	39.50	41.81	17
Huntington Lake North	37.39	44.81	37.63	35.34	43.61	46.04	225
Huntington Reservoir		46.5	43.78	32.64	40.39	36.32	115
Hyrum Reservoir	45.84	43.07	44.03	43.59	45.96	47.81	438
Joes Valley Reservoir	30.85	34.55	32.35	37.05	43.72	40.64	1,183
Johnson Reservoir	63.77	68.04	65.18	63.63	58.38	60.42	285
Jordanelle Reservoir			44.64	43.68	43.12	40.56	3,068
Kens Lake	56.81	44.01	45.01	36.31	38.83	42.51	86
Kents Lake		69.06	67.12	63.92	58.13	77.95	26
Kolob Reservoir	41.53	47.82	45.06	43.52	35.30	34.82	335
Koosharem Reservoir	73.87	55.4	65.86	56.97	64.73	56.53	310
Labaron Reservoir		51.05	65.47	60.04	46.87	56.23	24
Lake Mary	42.18	51.43	33.5	41.74	32.32	39.16	23
Lake Powell	42.47	36.58	35.13	35.07	E 35.10	NA	162,760
Little Creek Reservoir	45.14	37.51	40.41	36.39	42.04	30.06	65
Little Dell Reservoir			36.84	33.35	42.00	NA	249
Lloyds Reservoir	49.11	42.58	47.02	35.64	38.24	35.99	104
Long Park Reservoir		44.84	45.49	41.99	DRY	DRY	60
Lost Creek Reservoir	39.53	46.18	35.17	39.26	36.97	29.56	52

Table V-12. Utah Reservoir / Lake Monitoring List and TSI Evaluation.							
Lake / Reservoir	TSI Index 1989-90	1991-92	1993-94	1995-96	1997-99	1999-2001	Surface Area (Acres)
Lower Bowns Reservoir	50.05	41.31	47.18	48.35	40.72	40.21	90
Lower Box Reservoir		77.07	74.78	73.03	64.57	66.29	50
Lower Gooseberry Reservoir	45.69	44.26	40.82	40.31	46.12	45.08	57
Lyman Lake		37.74	31.21	34.92	32.96	31.82	27
Manning Meadow Reservoir		54.37	50.17	49.58	52.78	NA	59
Mantua Reservoir	54.93	58.05	59.56	55.13	48.21	45.21	554
Marsh Lake	28.14	34.36	30.42	30.9	37.46	40.51	38
Marshall Lake	36.27	29.51	31.77	31.27	38.83	27.56	18
Matt Warner Reservoir		53.35	61.26	55.76	57.28	52.63	433
Meeks Cabin Reservoir	47.13	42.42	40.19	39.89	44.13	45.93	477
Mill Hollow Reservoir	47.24	47.79	47.42	46.63	56.95	55.27	15
Mill Meadow Reservoir	67.06	69.15	55.75	59.74	50.48	55.66	156
Millers Flat Reservoir		40.84	42.35	32.74	37.92	32.46	65
Millsite Reservoir	35.07	41.46	35.19	37.42	45.85	55.81	435
Minersville Reservoir	59.98	56.23	66.48	56.29	56.33	53.20	990
Mirror Lake	38.23	39.95	31.69	37.91	42.78	40.77	50
Mona Reservoir		66.1	57.58	44.4	49.08	39.77	1,110
Moon Lake	46.79	38.08	37.42	41.15	43.93	42.53	768
Monticello Lake		46.71	45.46	45.08	36.12	38.92	3
Navajo Lake	34.03	35.41	39.71	41.15	39.93	42.58	714
New Castle Reservoir	48.12	53.92	41.78	47.5	54.15	47.22	163
Newton Reservoir	53.81	60.67	60.82	47.96	51.68	42.50	350
Nine Mile Reservoir	45.2	59.42	53.1	44.72	52.49	M 36.65	197
Oak Park Reservoir	48.61	47.89	42.44	44.79	45.46	46.26	382
Otter Creek Reservoir	57.44	43.54	55.23	59.19	55.59	55.15	2,520
Palisade Reservoir	45.73	58.86	39.61	38.17	40.42	40.72	66
Panguitch Lake	54.25	50.56	52.67	49.56	50.81	61.63	1,248
Paradise Park Lake		40.49	36.97	38.66	44.06	48.12	143
Pelican Lake	44.5	38.71	47.06	41.24	38.17	34.72	1,680
Pine Lake	44.14	34.48	19.66	30.64	42.04	53.1	77
Pineview Reservoir		58.31	39.97	42.5	46.58	41.30	2,874
Piute Reservoir	57.18	54.45	45.54	47.99	55.31	56.48	2,508
Porcupine Reservoir	38.05	40.09	38.44	37.45	46.23	42.87	190
Posey Lake	46.29	45.82	38.82	32.59	42.87	42.87	20
Puffer Lake	49.1	36.16	38.44	38.8	49.62	49.62	65
Quail Creek Reservoir	38.38	40.35	26.15	29.56	34.83	37.91	590
Recapture Creek Reservoir	45.61	49.16	44.5	35.56	40.64	39.75	265
Red Creek Reservoir (Iron)		53.14	57.3	40.22	52.81	47.57	39
Red Creek Reservoir		57.73	54.12	53.55	36.72	41.99	142
Red Fleet Reservoir	42.35	40.47	41.02	45.98	40.24	NA	520

Table V-12. Utah Reservoir / Lake Monitoring List and TSI Evaluation.							
Lake / Reservoir	TSI Index 1989-90	1991-92	1993-94	1995-96	1997-99	1999-2001	Surface Area (Acres)
Redmond Reservoir	68.68	75.03	70.71	67.34	63.44	69.88	160
Rexs Reservoir		45.8	50.21	48.29	43.17	49.49	46
Rockport Reservoir	43.88	42.98	41.78	45.48	40.76	30.85	1,189
Rush Lake	60.83	78.55	72.37	60.64	64.29	61.82	80
Salem Pond	45.89	50	39.81	45.89	44.76	M 38.57	11
Scofield Reservoir	62.69	55.77	53.22	41.69	45.08	45.95	2,815
Scout Lake		58.05	38.43	31.75	38.70	34.30	18
Settlement Canyon Reservoir	39.65	47.94	40.84	42.54	47.43	36.25	315
Sevier Bridge Reservoir	54.4	63.95	52.19	48.24	48.66	44.35	10,905
Sheep Creek Reservoir		45.87	46.1	40.85	37.79	31.37	86
Silver Lake Flat Reservoir					41.94	NA	54
Smith and Morehouse Reservoir	44.34	45.96	34.39	37.31	38.13	40.30	197
Spirit Lake	44.43	45.18	50.21	40.81	48.05	46.04	41
Stansbury Lake	55.77	57.22	58.31	49.55	49.27	49.41	120
Starvation Reservoir	54.86	41.45	36.66	40.14	39.16	39.10	2,760
Stateline Reservoir	46.29	39.66	41.41	40.74	41.79	45.21	288
Steinaker Reservoir	35.01	40.33	33.72	34.82	38.24	37.37	829
Strawberry Reservoir	55.6	53.47	48.43	45.68	45.87	48.18	17,160
Three Creeks Reservoir		50.83	57.32	54.09	49.92	42.37	57
Tibble Fork Reservoir	28.48	42.92	44.39	41.77	38.32	39.85	13
Tony Grove Lake	40.76	33.52	35.26	33.89	41.93	40.47	25
Trial Lake	42.92	37.95	39.51	35.22	43.21	48.27	98
Tropic Reservoir	47.71	36.75	39.12	29.08	38.33	35.67	180
Upper Enterprise Reservoir	73.65	58.37	54.18	54.41	44.15	44.15	200
Upper Stillwater Reservoir	39.21	38.93	25.21	35.16	38.17	39.76	252
Utah Lake	69.35	67.67	67.59	64.00	67.90	70.08	96,900
Wall Lake		31.83	39.18	28.98	37.94	26.55	61
Washington Lake		41.59	40.73	39.55	39.78	31.12	94
Whitney Reservoir	40.11	56.88	37.21	40.63	37.72	NA	188
Wide Hollow Reservoir	46.33	43.91	47.59	40.58	40.62	DRY	145
Willard Reservoir		62.84	47.68	52.66	47.43	45.92	10,000
Woodruff Creek Reservoir	40.92	48.6	43.14	42.37	45.11	NA	90
Yankee Meadows Reservoir		50.19	54.09	52.84	49.40	56.48	5

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Chapter VI: Appendices

Appendix VI-1. Methods For Determining Beneficial Use Support

Tables VI-1 through VI-4 are the criteria used to compare data against standards and pollution indicators found in *Standards of Quality for Waters of the State, R317-2, Utah Administrative Code* to determine beneficial use support of waterbodies that are not listed because of a UPDES discharge permit . The State of Utah exercises discretion in using data or information that goes beyond the criteria listed in the following tables and/or narrative for listing waterbodies and can include other types of information and best professional judgement.

Table VI-1. Criteria for Assessing Water as a Source of Drinking Water-Class 1C

Degree of Use Support	Field Monitoring (Toxicants)	Restrictions
Full	For any one pollutant, no more than one violation of criterion.	No source water closures or advisories
Partial	For any one pollutant, two or more violations of the criterion, but violations occurred in ≤10% of the samples.	One or more drinking water source advisories lasting less than 30 days per year.
Non	For any one pollutant, two or more violations of the criterion, and violations occurred in more than 10% of the samples.	One or more drinking water source advisories lasting greater than 30 days.

Table VI-2. Criteria for Assessing Primary and Secondary Contact Beneficial Use - Class 2A and 2B

Degree of Use Support	Restrictions	Fecal Coliform Bacteria
Full	No bathing area closures or restrictions in effect during reporting period.	Criterion 1 and Criterion 2 met.
Partial	On average, one bathing area closure per year of less than one week's duration.	Geometric mean met; not more than 25 percent of samples exceed 400 per 100 ml.
Non	On average, one bathing area closure per year of greater than one week's duration, or more than one bathing area closure per year.	Neither geometric mean nor maximum criteria limits achieved.

Table VI-2. Criteria for Assessing Primary and Secondary Contact Beneficial Use - Class 2A and 2B		
Degree of Use Support	**Restrictions**	**Fecal Coliform Bacteria**
Bacterial Criterion		
Criterion 1 = The geometric mean should not exceed 200 per 100 mL for any 30-day period. At least 5 samples should be collected in any 30-day period to be used in an assessment. The State prefers that at least 10 samples be collected during any 30-day period. When less than ten samples are collected, the State will look at historical data if available and/or other information before determining beneficial use support.		
Criterion 2 = Not more than 10 percent of the total samples taken during any 30-day period should have fecal coliform density that exceeds 400 per 100 mL. At least 5 samples should be collected in any 30-day period to be used in an assessment. The State prefers that at least 10 samples be collected during any 30-day period. For less than ten samples, there must be at least two samples that exceed the this criterion and the State will look at historical data if available and/or other information before determining beneficial use support.		

Table VI-3. Criteria for assessing Aquatic Life Beneficial Support-Classes 3A, 3B, 3C, 3D		
Degree of Use Support	**Conventional Parameters (pH, DO, Temperature)**	**Toxic Parameters (priority pollutants, chlorine, and ammonia)**
Full	For any one pollutant, no more than one exceedance of criterion or criterion was not exceeded in < 10% of the samples if there were two or more exceedances.	For any one pollutant, no more than one violation of acute criteria.
Partial	For any one pollutant, criterion was exceeded two times, and criterion was exceeded in more than 10% but not more than 25% of the samples.	For any one pollutant, two or more violations of the acute criterion, but violations occurred in ≤10% of the samples.
Non	For any one pollutant, criterion was exceeded two times, and criterion was exceeded in more than 25% of the samples.	For any one pollutant, two or more violations of the acute criterion, and violations occurred in more than 10% of the samples.
The State recommends that at least ten samples be used in making beneficial use support determinations. When less than ten samples are collected, the State will look at historical data if available and/or other information before determining beneficial use support.		
Total Phosphorus Assessment		
For **total phosphorus** , the following criteria were used to identify waters as '**needing further evaluation**'. If the **pollution indicator value** for total phosphorus (**0.05 mg/L**) was exceeded in more than 10% of the samples, and the mean of all samples was > **0.06 mg/L** the waterbody was identified as 'needing further evaluation or study' before a decision to list a stream waterbody on the 303(d) list. Additional evaluations could include benthic macroinvertebrate data, diurnal dissolved oxygen data, habitat quality evaluations, and fisheries data. Reports published or information collected by other entities can be used to determine beneficial use support.		

Table VI-4. Criteria for assessing Agricultural Beneficial Use Support - Class 4		
Degree of Use Support	**Conventional Parameter (Total Dissolved Solids)**	**Toxic Parameters**
Full	Criterion exceeded in less than two samples and in < 10% of the samples if there were two or more exceedances.	For any one pollutant, no more than one violation of criterion.
Partial	Criterion was exceeded at least two times, and criterion was exceeded in more than 10% but not more than 25% of the samples.	For any one pollutant, two or more violations of the criterion, but violations occurred in ≤10% of the samples.
Non	Criterion was exceeded at least two times, and criterion was exceeded in more than 25% of the samples.	For any one pollutant, two or more violations of the criterion, and violations occurred in more than 10% of the samples.

Appendix VI-2: Fish Consumption Advisory for Trout from the North Fork of American Fork Creek

The Utah Department of Environmental Quality, Utah Department of Health and the Utah County Health Department are advising the public of elevated arsenic levels in the meat of brown and cutthroat trout from the North Fork of American Fork Creek in Utah County. The advisory recommends that adults limit their consumption of trout taken from American Fork Creek to no more than one meal per month. Pregnant women, nursing mothers and children under age 12 should avoid eating any trout from the creek. This advisory is based on the agencies' review of fish contamination information provided by the USDA Forest Service.

Samples from brown and cutthroat trout taken from the creek were tested for heavy metals such as mercury, arsenic and lead. The data were assessed and the advisory issued based on risk-assessment methods developed by the U.S. Environmental Protection Agency (EPA). Results of the assessment show that eating more than one meal per month of these fish over a long period of time could result in an intake of arsenic that exceeds the EPA carcinogen screening value for the element. Although no known illnesses have been associated with consuming trout from the North Fork of American Fork Creek, long-term exposure to arsenic is suspected of causing cancer in humans, and exposure to high levels of arsenic has been linked with gastrointestinal effects, anemia and liver damage.

It is important to note that the health risk associated with eating the contaminated fish is based on long-term consumption and not tied to eating fish occasionally.

This advisory does not specifically include rainbow trout harvested from Tibble Fork Reservoir and from the North Fork of American Fork Creek below Tibble Fork Reservoir. The Utah Division of Wildlife Resources (DWR) manages these waters as put-and-take fisheries. Hatchery rainbow trout are stocked several times per year by DWR and most of these fish are harvested by the fall. The agencies currently have no data concerning arsenic levels in these fish. However, it is believed that the stocked fish do not live in the environment long enough to accumulate significant levels of arsenic.

Fish take in contaminants from the water they live in and the food they eat. Older, larger, predatory fish tend to have more arsenic than younger, smaller fish because these contaminants build up in fish over time. Because arsenic is bound in the muscle tissue of organisms, it cannot be removed or significantly reduced by methods such as frying, baking, grilling, smoking or other processing activities.

Arsenic is a naturally occurring element and exists at low levels throughout our environment. The arsenic in American Fork Creek is believed to be from both natural and mining-related sources associated with mineral deposits in the canyon. The USDA Forest Service is moving forward with a project to isolate, contain or otherwise dispose of mining wastes in the North Fork of American Fork Canyon. The objective of the project is to minimize the contribution of heavy metals to the environment from past mining activities on National Forest System lands. The Forest Service plans to begin appropriate removal actions at these sites during the 2002 construction season.

Fish consumption advisory signs will be posted at parking areas and access points along the creek. In addition, information about the advisory will be distributed at the USDA Forest Service fee station in American Fork Canyon. The agencies will continue to monitor contaminant levels of fish in the watershed and will update the advisory, as needed, based on additional information.

Fish are a good source of readily digestible protein. They are low in fat and sodium, and the unique type of fats found in fish is believed to provide cardiovascular benefits to humans.

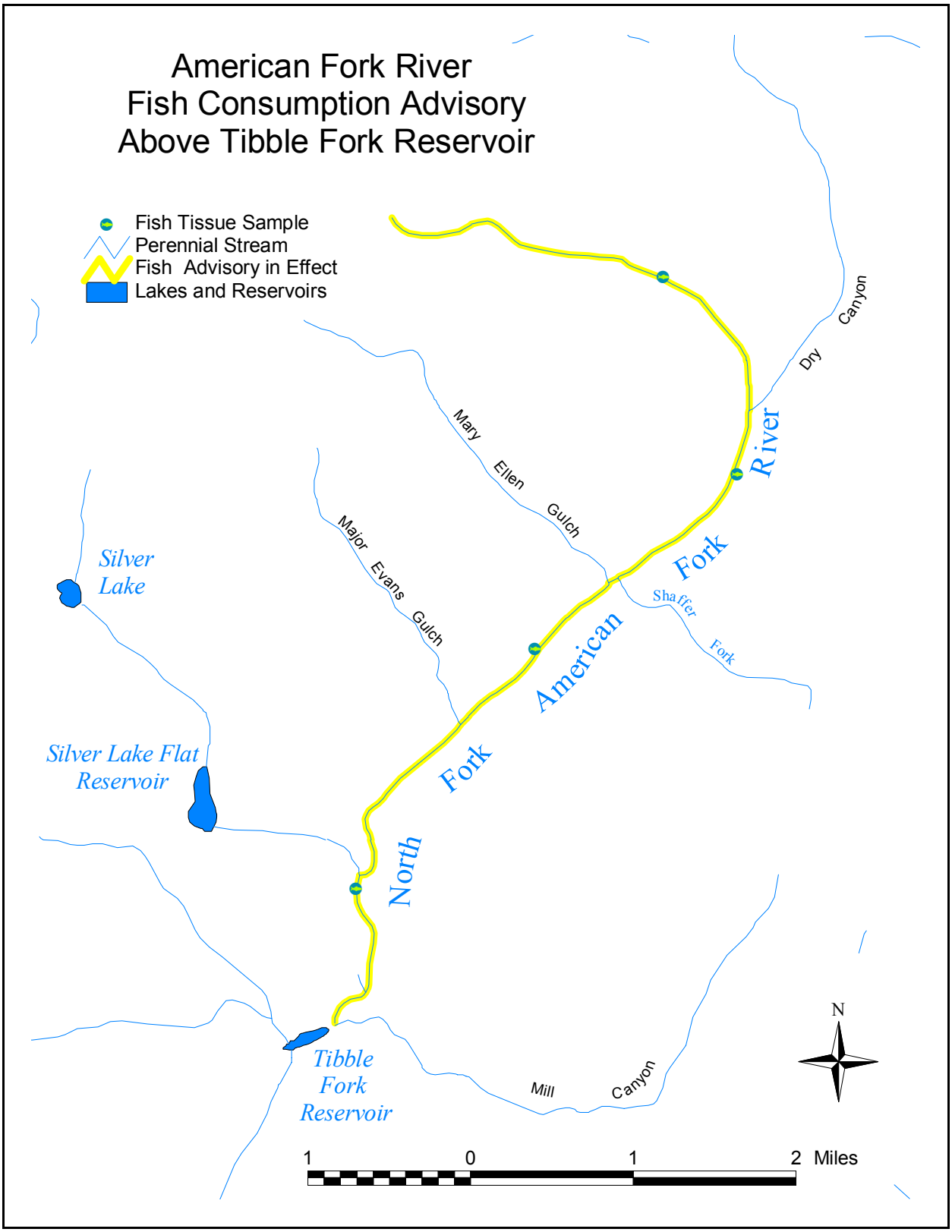

Figure VI-1. Fish consumption advisory for arsenic on the North Fork American Fork River.

Appendix VI-3. Beneficial Use Classifications for Waters in the State of Utah		
Class 1	--	Protected for use as a raw water source for domestic water systems.
Class 1A	--	Reserved.
Class 1B	--	Reserved.
Class 1C	--	Protected for domestic purposes with prior treatment processes as required by the Utah Department of Health.
Class 2	--	Protected for in-stream recreational use and aesthetics.
Class 2A	--	Protected for recreational bathing (swimming).
Class 2B	--	Protected for boating, water skiing, and similar uses, excluding recreational bathing (swimming).
Class 3	--	Protected for in-stream use by aquatic life.
Class 3A	--	Protected for cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain.
Class 3B	--	Protected for warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain..
Class 3C	--	Protected for nongame fish and other aquatic life, including the necessary aquatic organisms in their food chain.
Class 3D	--	Protected for waterfowl, shore birds and other water-oriented wildlife not included in Classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain.
Class 3E	–	Severely habitat-limited waters. Narrative standards will be applied to protect these waters for aquatic life.
Class 4	--	Protected for agricultural uses including irrigation of crops and stockwatering.
Class 5	--	Great Salt Lake, protected for primary and secondary recreation, aquatic wildlife, and mineral extraction.